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ABSTRACT

This book is a guide for the reinforcement of the elementary mathematics laboratory program. It uses a hands-on and activity approach with maximum involvement of the students. Reinforcement strategies for the first three phases (concrete, semiconcrete, and semiabstract) of each mathematics concept are suggested. Also included are specific job descriptions for a Title I Special Mathematics Teacher, a Mathematics Instructional Paraprofessional, and an Elementary Mathematics Instructional Specialist. (MM)

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MIPS TO THE "4"

MATHEMATICS
IMPROVES
PROMOTES
STUDENTS

A PROGRAM OF MATHEMATICS FOR THE ELEMENTARY MATH LABORATORY

Limited Edition
August, 1981
Division of Curriculum Services
Unified District 259
Wichita, Kansas

Dear MIP:

This book is a guide for reinforcement of the mathematics laboratory program. It is a hands-on and activity approach with maximum involvement of the students. The mathematics laboratory is a nongraded, nonfailure type room.

Elementary school students frequently become discouraged in learning mathematics because of a general inability to relate mathematical concepts to the facts of their daily lives and, at times, because they are asked to move too quickly from one concept to another. They soon become convinced that they cannot learn, so in the mathematics laboratory modifications of existing programs should, therefore, be made early enough to prevent this discouragement on the part of the student, and to provide him with the necessary challenge to keep his motivation high.

Students need to use more concrete manipulative activities than are normally provided in a school program. The ability to physically represent and manipulate numbers gives the student confidence and enables him to make a particular mathematical concept his own.

This book contains reinforcement strategies for the first three phases for each mathematical concept. The program also provides appropriate activities for the math laboratory.

Each child should begin his study of concepts at a level equal to his ability.

The MIP should be encouraged to improvise with any materials that are available and to devise additional activities tailored to specific laboratory needs.

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INTRODUCTION

The trend in mathematics is away from the text and cookbook recipe kind of mathematics and toward extensive laboratory work and open-ended experiments. Students are encouraged to move forward as rapidly as possible on an individual basis, with the more able students being encouraged to explore related projects. The imaginative and innovative teacher is freed from the tight textbook approach to mathematics.

Children must, from the beginning, be exposed to the structure of mathematics. They find concepts intensely interesting, can discover and make use of patterns and relationships, can think creatively and analytically, and are stimulated by and interested in new mathematical topics. Also, the learning process is shorter and more effective when it is based upon a conceptual approach that emphasizes the discovery of ideas.

When the actual experiences of children are used as the source of classroom activities, teachers will have little difficulty in making the work interesting and closely related to the needs of individual learners.

Students cannot learn by being told. They must see, hear, feel, smell, and taste for themselves. The terms hot, sharp, and wet have no meaning for children until they actually axperience the physical sensations associated with each word.

Piaget[1] emphasizes two things about active learning. First, a child must be allowed to do things over and over again and thus reassure himself that what he has learned is true. Second, this practice should be enjoyable. Anyone who has observed the look of sheer joy that enlivens the face of a young child when he succeeds in opening a door, standing up on skates, or solving a puzzle, will support Piaget on this point. Unfortunately, too many adults do not regard this as learning. Many still equate learning with work, and work with discomfort or unpleasantness. In fact, one of the most difficult problems for progressive teachers to overcome is the suspicion that many parents have for programs which their children obviously enjoy. "If they like school that much, they can't be working hard enough to learn anything."

This program is not one where children memorize a vast number of facts. It is a program designed to teach children exactly what certain facts mean. Many children have no understanding of what is going on in mathematics. They may be able to memorize statements such as 7 + 3 = 10, or 10 - 3 = 7 without the slightest idea of what those statements really mean. For these children, mathematics is an unending mystery. It will remain a mystery unless they are taught in a logical and precise manner exactly what mathematical statements mean.

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[1] Edith E. Biggs and James R. MacLean. Freedom to Learn. Redding, Massachusetts: Addison Wesley, 1969.

SCHOOL________________________________ NAME________________________________

Shade in the circle to indicate the student has demonstrated concept mastery.

GRADE K 1 2 3 4 5 6 (Circle current grade level)

1. COMPARISONS
   - ○ Large and small
   - ○ Tall and short
   - ○ Heavy and light
   - ○ Long
   - ○ More and less

2. POSITIONAL RELATIONSHIPS
   - ○ Under and over
   - ○ Top and bottom
   - ○ Front and back
   - ○ High and low
   - ○ Far and near
   - ○ Between
   - ○ Inside and outside

3. PATTERNING
   - ○ Two shapes
   - ○ Two colors
   - ○ Three shapes
   - ○ Three colors

4. COUNTING BY ONES
   - ○ Rational to 10
   - ○ Rational to 20
   - ○ Rational to 100
   - ○ Rote to 20
   - ○ Rote to 100
   - ○ Serial to 10
   - ○ Ordinals to fifth
   - ○ Ordinals to tenth
   - ○ Ordinals to twentieth

5. COUNTING BY TWOS
   - ○ Rational to 20
   - ○ Rote to 50

6. COUNTING BY FIVES
   - ○ Rational to 50
   - ○ Rote to 100

7. COUNTING BY TENS
   - ○ Rote to 100

8. COUNTING BY HUNDREDS
   - ○ Rote to 1000

9. RECOGNITION OF SETS
   - ○ (0-5)
   - ○ (0-10)

10. ONE-TO-ONE MATCHING
   - ○ Equivalent
   - ○ Non-equivalent
   - ○ One to ten
   - ○ One to fifty
   - ○ One to one hundred
   - ○ One to one thousand

11. RECOGNITION OF NUMERALS
   - ○ (0-10)
   - ○ (0-50)
   - ○ (0-100)
   - ○ (0-500)
   - ○ (0-1000)

12. NUMBER WORD RECOGNITION
   - ○ One to ten
   - ○ One to fifty
   - ○ One to one hundred
   - ○ One to five hundred
   - ○ One to one thousand

13. FORMING SETS FOR NUMERALS
   - ○ (0-10)
   - ○ (0-20)

14. MATCHING NUMERALS WITH SETS
   - ○ (0-10)
   - ○ (0-20)

15. WRITING NUMERALS
   - ○ (0-10)
   - ○ (0-50)
   - ○ (0-100)
   - ○ (0-500)
   - ○ (0-1000)

16. ORDER OF NUMERALS
   - ○ (0-10)
   - ○ (0-50)
   - ○ (0-100)
   - ○ (0-500)
   - ○ (0-1000)
   - ○ Number line

17. NUMBER COMPARISONS

○ Before
○ After
○ Between
○ One more
○ One less
○ Less than
○ More than
○ Even number
○ Odd number
○ Prime number
○ Number patterns

18. CONSERVATION OF SETS

○ (1-6)
○ (1-12)
○ (1-18)

19. JOINING SETS

○ (1-6)
○ (1-12)
○ (1-18)

20. ADDITION FACTS

○ (1-6)
○ (1-12)
○ (1-18)
○ Number line addition

1. SEPARATING SETS

○ (1-6)
○ (1-12)
○ (1-18)

2. SUBTRACTION FACTS

○ (1-6)
○ (1-12)
○ (1-18)
○ Number line subtraction

23. PLACE VALUE

○ Ones
○ Tens
○ Hundreds
○ Thousands
○ Millions
○ Billions
○ Expanded notations

24. RENAMING

○ Ones ↔ Tens
○ Tens ↔ Hundreds
○ Hundreds ↔ Thousands

25. ADDITION OF WHOLE NUMBERS

○ Missing addend
○ 3 addends
○ 2 digit addends (no renaming)
○ 2 digit addends (renaming)
○ 3 digit addends (no renaming)
○ 3 digit addends (renaming)
○ 4 digit addends
○ Worded problems

26. SUBTRACTION OF WHOLE NUMBERS

○ 2 digit (no renaming)
○ 2 digit (renaming)
○ 3 digit (no renaming)
○ 3 digit (renaming)
○ 4 digit
○ Worded problems

27. EQUIVALENT SUBSETS

○ Twos
○ Threes
○ Fours
○ Fives
○ Sixes
○ Sevens
○ Eights
○ Nines

28. MULTIPLICATION FAC

○ To 3x3
○ To 4x4
○ To 5x5
○ To 7x7
○ To 9x9
○ Number line multiplication

29. SYMBOLS

○ (+) ○ (-)
○ (x) ○ (÷)
○ (<) ○ (>)
○ ($) ○ (¢)
○ (%) ○ (π)
○ Triangle
○ Square
○ Rectangle
○ Circle
○ (o) ○ (=)
○ Point ○ Segment
○ Ray ○ Line
○ ⊥ lines
○ Parallel lines
○ Intersecting lines
○ Angle ○ Right an
○ Right triangle
○ Quadrilateral
○ Parallelagram
○ Rhombus

29. SYMBOLS, cont.

- ○ Pentagon
- ○ Hexagon
- ○ Octagon
- ○ Cube
- ○ Cone
- ○ Cylinder
- ○ Sphere
- ○ Prism

30. CLASSIFICATION OF NUMBERS

- ○ Composite
- ○ Prime
- ○ Common fractions
- ○ Decimals

31. ROMAN NUMERALS

○ (I-X) ○ (X-L)
○ (L-C) ○ (C-M)

32. PARTITIONING SETS

- ○ By twos
- ○ By threes
- ○ By fours
- ○ By fives
- ○ By sixes, sevens
- ○ By eights, nines

33. DIVISION FACTS

- ○ To 9÷3
- ○ To 16÷4
- ○ To 25÷5
- ○ To 49÷7
- ○ To 81÷9
- ○ Number line division

34. MULTIPLICATION OF WHOLE NUMBERS

- ○ 10 as a multiplier
- ○ 2 digit by 1 digit
- ○ 2 digit by 2 digit
- ○ 3 digit by 2 digit
- ○ 100 as a multiplier
- ○ 3 digit by 3 digit
- ○ Worded problems

35. DIVISION OF WHOLE NUMBERS

- ○ 1 digit divisor (no remainder)
- ○ 1 digit divisor (remainder)
- ○ 10 as a divisor
- ○ 2 digit divisor
- ○ 100 as a divisor
- ○ 3 digit divisor
- ○ Worded problems

36. FRACTIONS

○ (1/2) ○ (1/4)
○ (3/4) ○ (1/3)

- ○ (2/3)
- ○ Regions
- ○ Sets
- ○ Fractional parts of one
- ○ Renaming in simplist form
- ○ Renaming in equivalent form
- ○ Mixed numeral ↔ fractions
- ○ Order on number line

37. ADDITION OF FRA[illegible]ONS

- ○ Like denominators with sums less than one
- ○ Like denominators with sums greater than one
- ○ Unlike denominators
- ○ Mixed numerals

38. SUBTRACTION OF FRACTIONS

- ○ Common fractions with like denominato
- ○ Common fractions with unlike denominators
- ○ Whole number Common fractions
- ○ Mixed numeral Common fractions
- ○ Mixed numeral mixed numeral

39. MULTIPLICATION O[illegible] FRACTIONS

- ○ Common with 1 as a numerator
- ○ Common fractions
- ○ Whole number x common
- ○ Improper x common
- ○ Improper x Improper
- ○ Mixed number x common
- ○ Mixed number x mixed number

40. DIVISION OF FRACTIONS

- ○ Whole number ÷ common
- ○ Common fractions
- ○ Improper ÷ common

DIVISION OF FRACTIONS, cont.

- ○ Improper ÷ improper
- ○ Mixed number ÷ common
- ○ Common ÷ mixed number
- ○ Whole number ÷ mixed number

DECIMAL FRACTIONS

- ○ Tenths
- ○ Hundredths
- ○ Thousandths
- ○ Order on number line

DECIMALS

- ○ Place value
- ○ Expanded notation
- ○ Addition
- ○ Subtraction
- ○ Multiplication
- ○ Division

ENGLISH MEASUREMENT

- ○ Cup ○ Pint
- ○ Quart ○ Gallon
- ○ Inch ○ Foot
- ○ Yard
- ○ Ounce ○ Pound

MEASUREMENT OF TIME

- ○ Hour
- ○ Half-hour
- ○ Quarter time
- ○ Exact time

45. METRIC MEASUREMENT

- ○ Metre ○ Litre
- ○ Gram
- ○ Centi- cm, cg, cl
- ○ Deci- dm, dg, dl
- ○ Deka- dam, dag, dal
- ○ Kilo- km, kg, kl
- ○ Milli- mm, mg, ml
- ○ Hecto- hm, hg, hl

46. MEASUREMENT OF MONEY

- ○ Penny ○ Nickel
- ○ Dime ○ Quarter
- ○ Half dollar
- ○ Dollar
- ○ Knows values
- ○ Makes change

47. MEASUREMENT OF GEOMETRIC FIGURES

- ○ Angles in degrees
- ○ Perimeter of polygons
- ○ Circumference of circles
- ○ Area of rectangles
- ○ Area of triangles
- ○ Area of circles
- ○ Volume of prism

48. INTERPRETATION OF GRAPHS

- ○ Charts and tables
- ○ Pictorial
- ○ Line
- ○ Bar
- ○ Circle
- ○ Number pairs

49. CONSTRUCTION OF GRAPHS

- ○ Charts and tables
- ○ Pictorial
- ○ Line
- ○ Bar
- ○ Circle
- ○ Number pairs

50. MATHEMATICAL APPLICATIONS

- ○ Compute averages
- ○ Compute percentages
- ○ Use formulas
- ○ Ratio--Proportion problems
- ○ Solve equations
- ○ Rounding numbers
- ○ Congruent figures
- ○ Story problems
- ○ Money story problems

51. INTEGERS

- ○ Positive
- ○ Negative
- ○ Opposites
- ○ Addition
- ○ Subtraction

ELEMENTARY MATHEMATICS PROGRAM

Teachers are responsible for:

(1) Teaching math to all the children in their classroom and seeing that each child develops his math potential to its maximum.

(2) Teaching → evaluating → reteaching and reevaluation for concept mastery.

(3) Grouping their children for math instruction. (Each group could be working on a different concept or the same concept at different levels.)

(4) Informating the MIP in writing (on Friday) of the concept(s) to be worked on with each lab group for the coming week and suggesting possible lab activities. (Remember the MIP is not a certificated teacher.)

(5) Participating in the inservice training activities provided by the program.

(6) Keeping their children's skill sheets current, using only the designated markings.

(7) Using the adopted math text only as a supplement to the Elementary Mathematics Program.

(8) Identifying and providing additional instructional time for those children in the Title I schools who have been identified as having mathematical concept deficiencies.

UBJECT: Job Description for Title I Special Mathematics Teacher

The Title I Special Mathematics Teacher is responsible for the improvement of the mathematics skills of students involved in the RID (Remediating Individual Deficiencies) Program. The Special Mathematics Teacher is responsible to the building principal where he/she is assigned. He/she must adhere to building policies as set down by the building principal. The Special Mathematics Teacher's principle responsibilities are to:

1. Assist the classroom teacher in selecting students for the RID Program. (Those below the 9th percentile on the ITBS.)
2. Teach basic mathematics skills to children enrolled in the RID Program and see that each child develops his/her mathematics potential to its maximum.
3. Diagnose the computational skill deficiencies of each student in the RID Program.
4. Work cooperatively with the classroom teacher to develop a math educational plan to remediate the deficiencies identified for each student in the RID Program.
5. Provide information about the RID Program to parents of children involved in the program.
6. Provide instructional materials and teaching activities appropriate to the individual needs of students in the RID Program. (Concrete thru abstract.)
7. Administer criterion referenced tests to determine RID students' concept mastery.
8. Complete an IBM participation card on each student in the RID Program and send to Research.
9. Complete a participation form on each RID student and send him to child's parents.
10. Administer California Achievement Tests to RID students for pretest and later posttest information.
11. Complete and send performance report to parents for each student in the RID Program. These will accompany the child's report card.
12. Keep an accurate record of the computational skill achievement of each child in the RID Program.
13. Participate in conference on staffing that involve RID students.
14. Participate in inservice training activities provided for the RID Teachers.

SUBJECT: Job Description for Elementary Mathematics Instructional Paraprofessional

The Elementary Mathematics Instructional Paraprofessional is responsible for assisting project teachers in improving the mathematics skills of their pupils. The Elementary Mathematics Instructional Paraprofessional is responsible to the building principal. The paraprofessional must adhere to building policies as set down by the building principal. The principle responsibilities of the paraprofessional are to:

1. Administer the oral pretest to each kindergarten child. Administer the written to 1st grade children who qualify for lab.

2. Construct visual aids for use in the classroom when requested by teacher or instructional specialist. These visual aids would include: interest center devices, games for motivational drill, overhead projector transparencies, and various other teaching aids.

3. Reproduce test materials as requested by teachers for classroom use. (Concept Test Mastery)

4. Give oral tests to children for concept mastery when requested by teachers. (Counting)

5. Work with students in the mathematics lab as directed by the teachers. (Approximately seventy-five percent of the Instructional Paraprofessional's time will be utilized working with children in the lab.)

6. Construct the mathematics teaching aids that are to be used in the lab.

7. Conduct tours of the mathematics lab and demonstrate the various teaching aids used in the project to non-project teachers and parents who are visiting the mathematics lab.

8. Assist project teachers in notifying parents of their child's participation in math lab.

9. Administer the pretest and posttests needed for program evaluation.

10. Complete an IBM participation card on each student involved in the Title I Mathematics Lab Program.

11. Fill in pretest and posttest data on IBM scan sheets (form #103) and send to Research.

12. Take advantage of preservice and inservice training opportunities.

SUBJECT: Job Description for Elementary Mathematics Instructional Specialist

The Elementary Mathematics Instructional Specialist is responsible for improvement of instruction and inservice education in the mathematics program. The specialist is directly responsible to the Mathematics Coordinator who is the director of the Title I Elementary Mathematics Program. The specialist's principle responsibilities are to:

1. Observe mathematics lessons and techniques periodically to insure ongoing progress in the Elementary Mathematics Program.
2. Upon request, provide demonstrations appropriate to the concept currently being taught in the classroom.
3. Assist in the evaluation of concept development for the students in the program. This will help to individualize the program.
4. Assist the classroom teachers in developing a workable plan for the implementation of the mathematics program in his/her classroom.
5. Conduct building level inservice meetings involving principals, teachers, parents and mathematics instructional paraprofessionals.
6. Conduct program inservices for each grade level as requested by the classroom teacher.
7. Assist the Mathematics Coordinator in conducting summer workshops for teachers new to the program.
8. Assist the Mathematics Coordinator in revising the current Elementary Mathematics Program.
9. Order supplies requested by the teachers and see that they are distributed.
10. Maintain an inventory of Title I equipment purchased by the program.
11. Meet with the Mathematics Coordinator to discuss common concerns and offer suggestions.
12. Assist the Mathematics Coordinator in the dissemination of the Elementary Mathematics Program to interested non-project personnel and parents.
13. Diagnose, prescribe, teach, evaluate and reteach basic mathematics skills for those students identified as most educationally needy. (Intermediate Grade Specialists only)

SUBJECT: Job Description for Title I Mathematics Coordinator

The Title I Mathematics Coordinator is responsible for monitoring the various components of the Title I Elementary Mathematics Program. The coordinator is directly responsible to the Mathematics Coordinator who is the Director of the Title I Elementary Mathematics Program.

The coordinator's principle responsibilities are to:

1. Fulfill all responsibilities of the Title I Mathematics Consultant.
2. Arrange for interested non-project personnel to visit the Title I Elementary Mathematics Program.
3. Coordinate all Title I Elementary Mathematics Program media releases.
4. Coordinate requests from interested groups desiring more information about the Title I Elementary Mathematics Program.
5. Complete necessary paperwork needed to gain local and state approval of preservice and inservice training sessions for teachers and aides.
6. Arrange for meeting rooms for preservice and inservice training sessions.
7. Complete required forms to gain approval from Wichita State University to offer preservice training sessions for graduate credit.
8. Monitor the preservice and inservice training sessions and secure signed attendance forms from all those in attendance.
9. See that grade report forms are completed and sent to Wichita State University at the conclusion of the preservice training workshop.
10. Send memo to Title I Director identifying those persons who have completed preservice or inservice training sessions and the amount of stipend payment due them.
11. Meet with the Mathematics Coordinator on a regular basis to discuss the status of the Title I Elementary Mathematics Program.
12. Meet with the Mathematics Consultants on a regular basis to discuss implementation procedures, possible program adjustments, and sharing of common concerns.

COMPARISONS
Comparison of objects - by inspection

Introduction

Children should be given frequent opportunities for comparing objects with respect to such properties as: size, height, weight, and age. They should be encouraged to see that, at this stage, they are comparing the objects in sets, according to some common property (color, weight, age, etc.). At a later time they will be expected to compare sets of objects according to the one property common to all sets (the number of objects they contain). At that time, the color, size, weight, height, and shape of the objects in the sets will be irrelevant when considering the basic number property. They will then learn that the number of objects contained in a given set is called the "cardinal number" of the set.

The terms "equal to" and "same as" may now be introduced. When comparing two sets which do not have the same number of elements, the instructor is laying the ground work for the concept of order of numbers. Terms such as "more than", "less than", "most", "fewest", etc., may be introduced at this time.

CONCEPT: Comparisons - length

Equipment: Three objects with obviously different lengths (e.g., boards, sticks, dowel rods, pencils, etc.)

Activity: The objects being compared are placed so all can see them. The children then choose the longest, the shortest, and arrange them from shortest to longest. They should also be able to arrange them from longest to shortest.

****

Equipment: Flannel boards
Flannel shapes of different lengths (e.g., rectangles, squares, rods, etc.)

Activity: The shapes are placed on the flannel board for all to see. The children are given a chance to compare the lengths. One child selects the longest one and the shortest one. The students will then arrange the flannel shapes from shortest to longest, and from longest to shortest.

****

Equipment: Magnetic board
Magnetic objects of different lengths (e.g., giraffes, worms, etc.)

Activity: The magnetic giraffes are placed on the magnetic board. The students are given a chance to compare the lengths. The students will then arrange the magnetic giraffes. from shortest to longest, and from longest to shortest

****

Equipment: Magic slate

Activity: Each child will have a magic slate. The children are instructed to draw three line segments by different lengths. They are then told to draw an "X" on the longest segment, an "O" on the smallest segment.

CONCEPT: Comparisons - volume

Equipment:	12 identical containers (baby food jars, pill bottles, etc.). 4 different commodities (rice, beans, etc.).
Activity:	Take each commodity and place different amounts in three containers. Mix up the containers. Ask the children to match the containers according to commodity and then arrange them according to amounts. Questions similar to the following should be asked: Which container has the most rice? Which container has the least corn, etc.?

****

Equipment:	Demonstration flannel or magnetic board Cutouts for flannel or magnetic boards of identical containers indicating different volumes
Activity #1:	Place the cutouts on the board. A child is required to select the one containing the least or the most volume. Repeat with different cutouts.
Activity #2:	Place one cutout on the board. A child is required to place a cutout on the board that has either more or less volume.

****

Equipment:	Overhead projector
Activity:	Two containers are drawn on the overhead projector, one to show a given amount. Require a child to fill in the other container with either more or less than the given one.

CONCEPT: Comparison of sets - by inspection

Equipment:

Three display trays
Counters (sticks, blocks, discs, etc.)

Activity:

The three display trays are placed on a table in front of the class. They must contain obviously different numbers of elements (counters). The children then react to the following directions:

1. "Choose the tray with the fewest counters."
2. "Choose the tray with the most counters."
3. "Arrange the trays from left to right going from the fewest to the most."
4. "Arrange the trays from left to right going from the most to the fewest."

This can be repeated with different sizes of sets and counters.

****

Equipment:

Flannel board
Flannel objects

Activity:

Three sets are formed on the flannel board with each set having an obviously different number of elements. The following questions should be asked:

1. "Which set contains the most objects?"
2. "Which set contains the fewest objects?"

The activity can be repeated with three new sets. The MIP must not allow the children to count the elements.

****

Equipment:

Flannel board
Flannel shapes
Magnetic board
Magnetized shapes

Activity:

Four sets are formed on the flannel or magnetic boards. Two of the sets should have the same number of elements, while the other two will have an obviously different number of elements. The following questions are asked:

1. "Which set contains the most objects?"
2. "Which two sets contain the same number of objects?"
3. "Which set contains the fewest objects?"

The children must not be allowed to count the elements.

CONCEPT: Comparisons of sets - by inspection

Equipment: Overhead projector (coins, discs, shapes - for showing images).

Activity: Four sets are formed on the overhead projector. Two of the sets will have the same cardinal number and the other two will have an obviously different number of elements. These questions should be asked:

1. "Which set has the most objects?"
2. "Which two sets have the same number of objects?"
3. "Which set has the fewest objects?"

The children are not allowed to count the elements.

****

Equipment: Overhead projector
Several transparencies showing sets (some equal and others with a different number of elements)

Activity: The MIP cuts out the sets from the transparencies. Four sets are placed on the overhead projector. The children then respond to the following directions:

1. "Show me the largest set." (One having the most elements.)
2. "Show me the smallest set."
3. "Show me the two sets that have the same number of objects."
4. "Arrange the sets from the fewest to the most."
5. "Arrange the sets from the most to the fewest."

This can be repeated with different sets.

CONCEPT: Comparisons - age

Equipment: Flannel board
Pictures of the faces of people of various ages (backed with sandpaper or velour paper so they will adhere to the flannel board).

Activity #1: A picture of an adult and a child is placed on the flannel board. The MIP asks someone to identify the older person. Two different pictures are placed on the flannel board and a child is asked to identify the younger person.

Activity #2: Place pictures of persons representing three or more different ages on the flannel board (baby, child, adult, older adult). Ask a child to identify the youngest and oldest person and arrange their pictures according to their ages.

Activity #3: Place one of the pictures on the flannel board. Ask a child to place a picture of a person that is either younger or older on the flannel board.

****

Equipment: Magnetic board
Pictures of the faces of people of various ages (backed with a piece of magnet so they will adhere to the magnetic board)

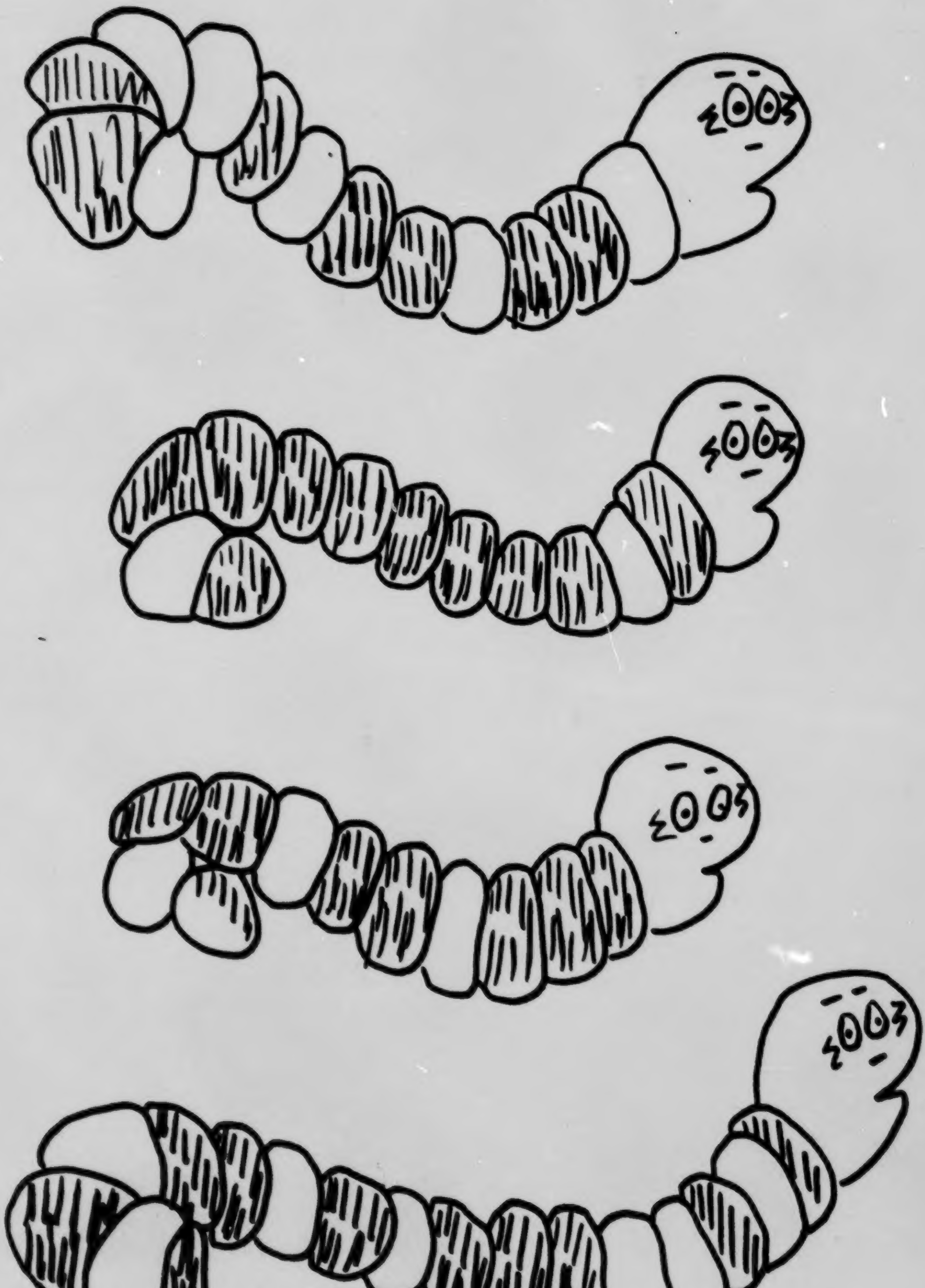
Activity: Repeat all of the above activities using the magnetic board.

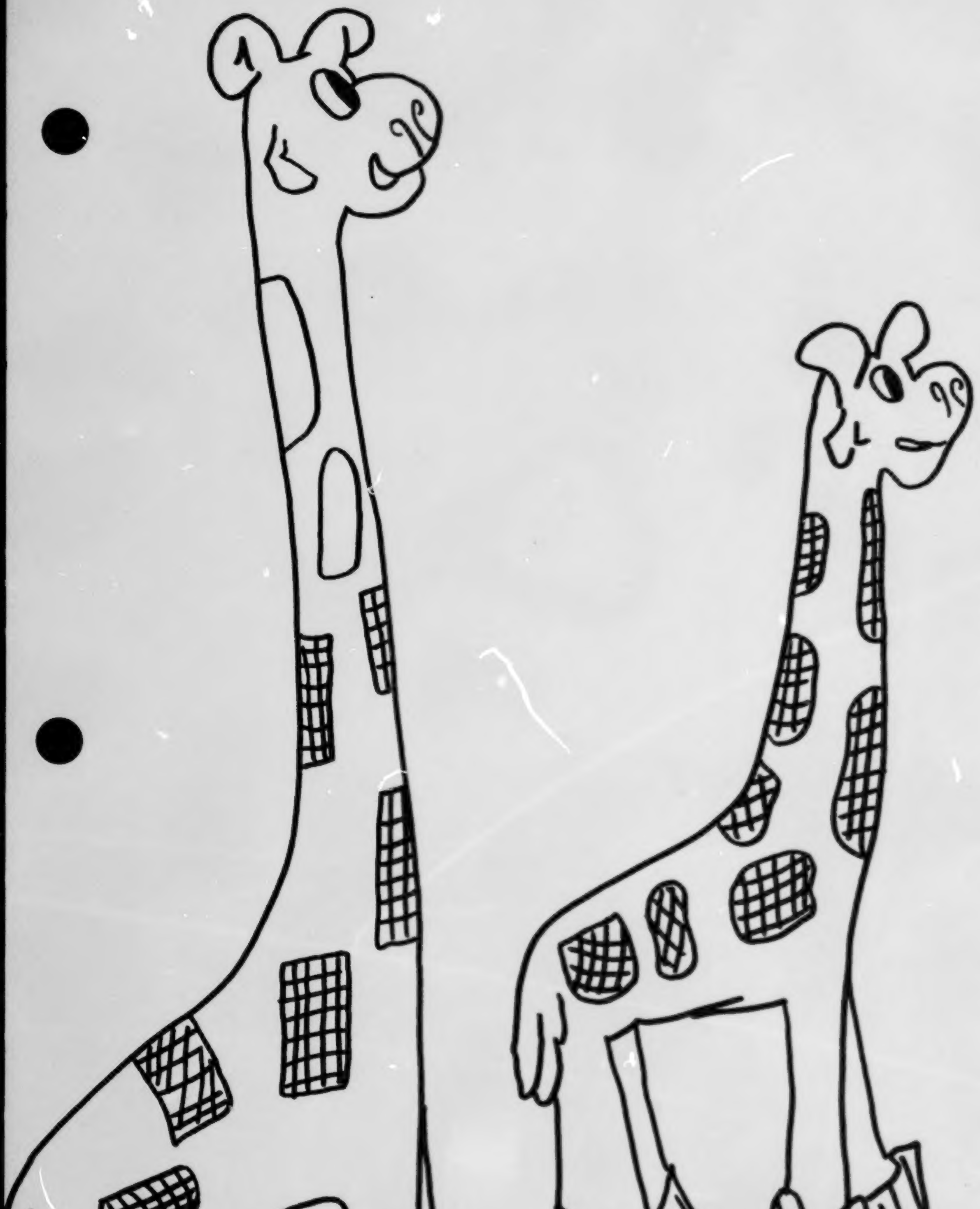
****

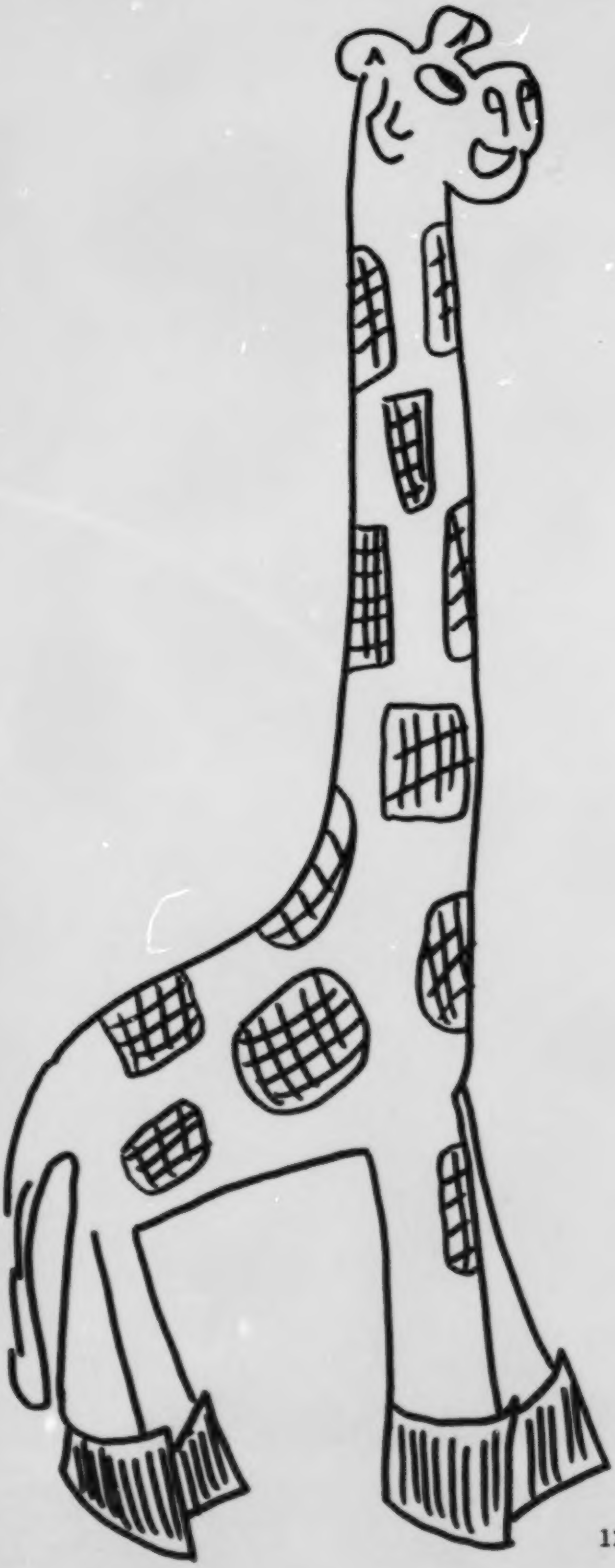
Equipment: Overhead projector
Transparencies of the faces of people of various ages

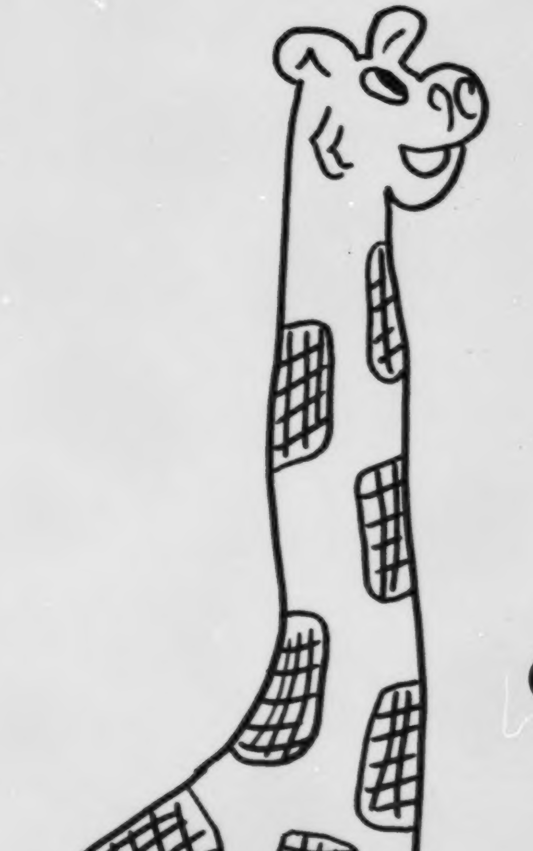
Activity: Repeat all of the flannel board activities using the overhead projector and transparancies.

MAGNETIC WORMS









POSITIONAL RELATIONSHIPS

Introduction

Terms of location, such as "between", "in front of", and "behind", involve a form of comparison, since they require the establishment of a relationship between two objects.

The importance of these terms will become apparent when considering the order of numerals. The numeral 5 can be described as the numeral "before" the numeral 6; the numeral 5 can be described as the numeral "after" the numeral 4; or, the numeral "between" the numerals 4 and 6.

The child needs a variety of experiences concerning positional concepts as related to objects.

NOTE: There are no activities listed for the concepts of "far" and "near" in the book.
Interaction with the children can be verbal, who is nearest the door?, which is the farthest from the child, the swings on the playground or the pencil sharpener in the lab, etc.

CONCEPT: Positional relationships

Equipment: Children
Chairs

Activity: The MIP will give the following directions to all the children concerning their relative positions with their chairs:

1. "Sit on your chair."
2. "Stand in back of your chair."
3. "Stand in front of your chair."
4. "Place your foot under your chair."
5. "Stand on the left side of your chair."
6. "Stand behind your chair."
7. "Stand on the right side of your chair."
8. "Stand on your chair."

To make this more complicated, three chairs of different sizes can be placed in front of the class. The following instructions should be given:

1. "Stand in front of the largest chair."
2. "Stand behind the smallest chair."
3. "Sit on the chair that is in the middle."
4. "Sit behind the smallest chair."
5. "Sit on the largest chair."
6. "Sit on the smallest chair."

****

Equipment: Chair
Toy car

Activity: The children are asked to respond to the following directions:

1. "Place the car on the chair."
2. "Place the car under the chair."
3. "Place the car behind the chair."
4. "Place the car beneath the chair."
5. "Place the car in back of the chair."

Place two chairs in front of the children:

6. "Place the car between the chairs."

CONCEPT: Geometry - closed curves

Equipment: None

Activity #1: A large circle is drawn on the floor. One child is asked to stand "on" the circle. Someone else is asked to stand "inside" the circle. A different person stands "outside" the circle.

Activity #2: The children form a circle by joining hands. Someone stands "inside" the circle of children and someone else stands "outside" the circle.

****

Equipment:
Flannel board
Flannel animals
Pieces of yarn

Activity: The flannel animals are placed on the flannel board. The yarn is placed around some of the animals, and the children are told it is a fence to keep the animals from running away. Someone points to the animals that are "outside" the fence. Someone else points to the animals that are "inside" the fence.

****

Equipment:
Magnetic board
Magnetic objects
Chalk

Activity: Several objects are placed on the magnetic board. A closed curve is then drawn around some of the objects. The children are to identify objects "inside" and "outside" the closed curve.

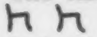
****

Equipment: Individual magic slates

Activity: The children are told to draw a closed curve on their magic slates. Then, they put two triangles "inside" the curve and three dots "outside" the curve. Their slates should be held up for the teacher's observation.

CONCEPT: Positional relationships

Equipment: Flannel board
Flannel objects (table, ball, two chairs)

Activity: The MIP places the flannel table on the flannel board. A student will then place the ball on top of the table. Someone else may place the ball under the table. The ball may also be placed to the right or left of the table. All objects are then removed from the flannel board. The MIP will place two chairs on the flannel board, thus:  . A student puts the ball between the chairs. One chair is then removed from the flannel board. The children respond to the following directions:

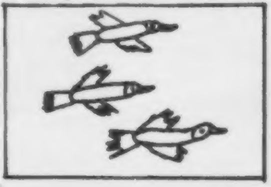
1. "Place the ball behind the chair."
2. "Place the ball on the chair."
3. "Place the ball under the chair."
4. "Place the ball in front of the chair."

****

For alternate activities, teacher arranges the objects and requires the children to verbalize the correct response.

Equipment: Flannel board
Three birds made of flannel
Three airplanes made of flannel

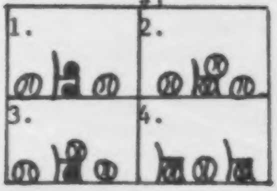
Activity: The three birds are put on the flannel board, similar to the following pattern. It is best to make the birds different colors for easy identification. First, the class should identify the bird that is the highest in the air, and then the one that is the lowest. This activity can be repeated using airplanes.



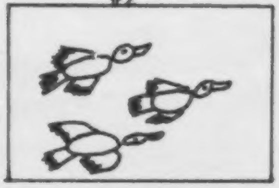
****

Equipment: Overhead projector
Pen
Prepared transparencies, Examples:

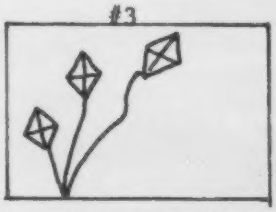
#1



#2



#3



Activity: On transparency #1, different children will mark the correct response, with reference to questions concerning the relative position of the ball to the chair(s).

1. "Mark the ball under the chair."
2. "Mark the ball on the chair."
3. "Mark the ball that is behind the chair."
4. "Mark the ball that is in front of the chair."

Using transparencies #2 and #3, the terms "highest" and "lowest" can be discussed.

REINFORCEMENT ACTIVITIES

CONCEPT: Positional Relationships

ACTIVITY:

Once there was big rock. One day a little worm came crawling by.

"I wonder what is on the other side of this rock?" said the little worm.

She tried to get on top of the rock, but it was too slippery and she fell off. She tried to jump over the rock, but it was too high. She tried to fly above the rock, but of course the little worm had no wings.

The little worm thought, "I could crawl around the rock, but it would take me a long time to get around this big rock."

So what did the little worm do? (Children guess.) She burrowed under the rock to the other side.

A bird wanted to see what was on the other side of the rock.

"Can I burrow under the rock?" asked the little bird. "No! Shall I jump over the rock? No! Could I walk around the rock or climb on top of the rock? No, it would be easier for me to fly above the rock and see what is on the other side."

That's what the bird did.

The rabbit wanted to see what was on the other side of the rock.

He said to himself, "Shall I burrow under this rock? No! Shall I fly above this rock? Of course not. I have no wings. Shall I crawl on top of this rock? No, I don't crawl very well. I could walk around to the other side, but that would take too long. It would be quicker for me to jump over the rock."

And that's just what the rabbit did.

The ant could not fly over the rock, or crawl under the rock, or run fast around the rock to the other side, or jump over the rock.

The ant said, "It is easier to crawl on top of the rock to see what is on the other side."

And the ant did just that. She crawled on top of the rock.

The turtle could not get on top of the rock, or burrow under the rock, or fly above the rock, or jump over the rock. So what do you think the turtle did to get to the other side of the rock?

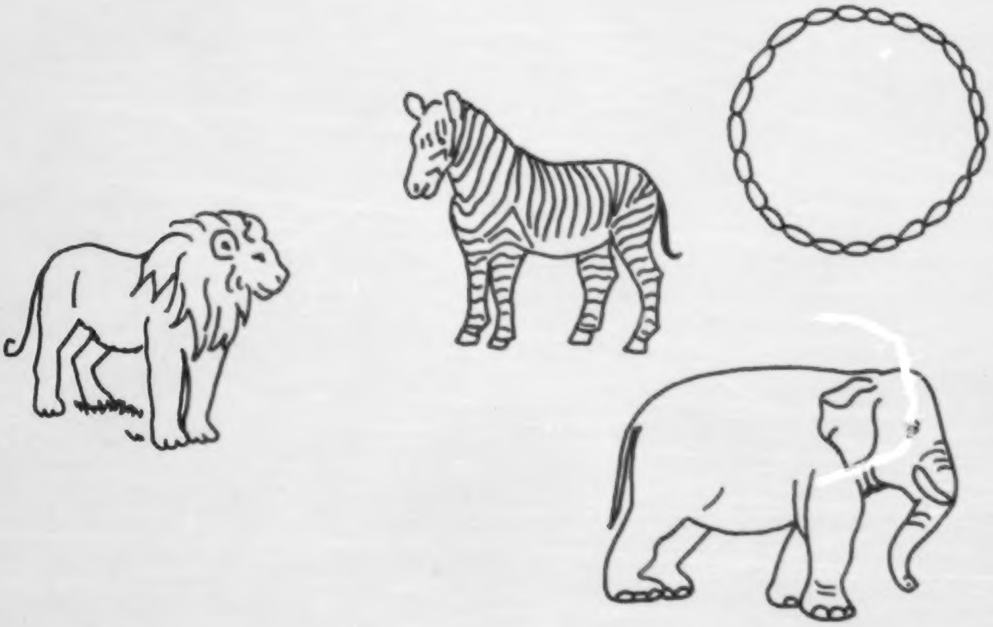
The turtle walked around the rock.

CONCEPT: Positional relationships

Equipment: String or rope
Animals

Activity: The children will each have an animal and string tied in circle. The children respond to the following directions:

1. "Place the animal inside the circle."
2. "Place the animal outside the circle."
3. "Place the animal on the circle."



CONCEPT: Positional relationship

Activity: WILLIE, TILLIE AND MILLIE

The purpose of this story is to reinforce the understanding of descriptive and positional words: big, little, middle-sized, large, left, right, behind, in front of, beside, under, outside, inside, around, first, second, third, fourth, and last. The story may be dramatized with figures on the flannelboard or may be acted out using classroom items for props.

Willie, Tillie and Millie were three pigs. Willie was big, Tillie was middle-sized, and Millie was little.
The three pigs said in grunty voices,

"Oink, oink, oink.
Piggy-wigs are we.
Oink, oink, oink.
1, 2, 3."

Willie, the big pig, grunted, "Let's go exploring."
Tillie turned to the right.
And she went out of sight.
The other pigs said,
"Oink, oink, oink,
What shall we do?
Oink, oink, oink,
Now we are only two."

Tillie, who was middle-sized, said, "I'm going exploring, too."
And to the left he went
Without anyone's consent.
The third pig, Millie, who was little, said,
"Oink, oink, oink, oh, my!
Only one little pig am I."

So what did Millie do?
He went exploring, too.

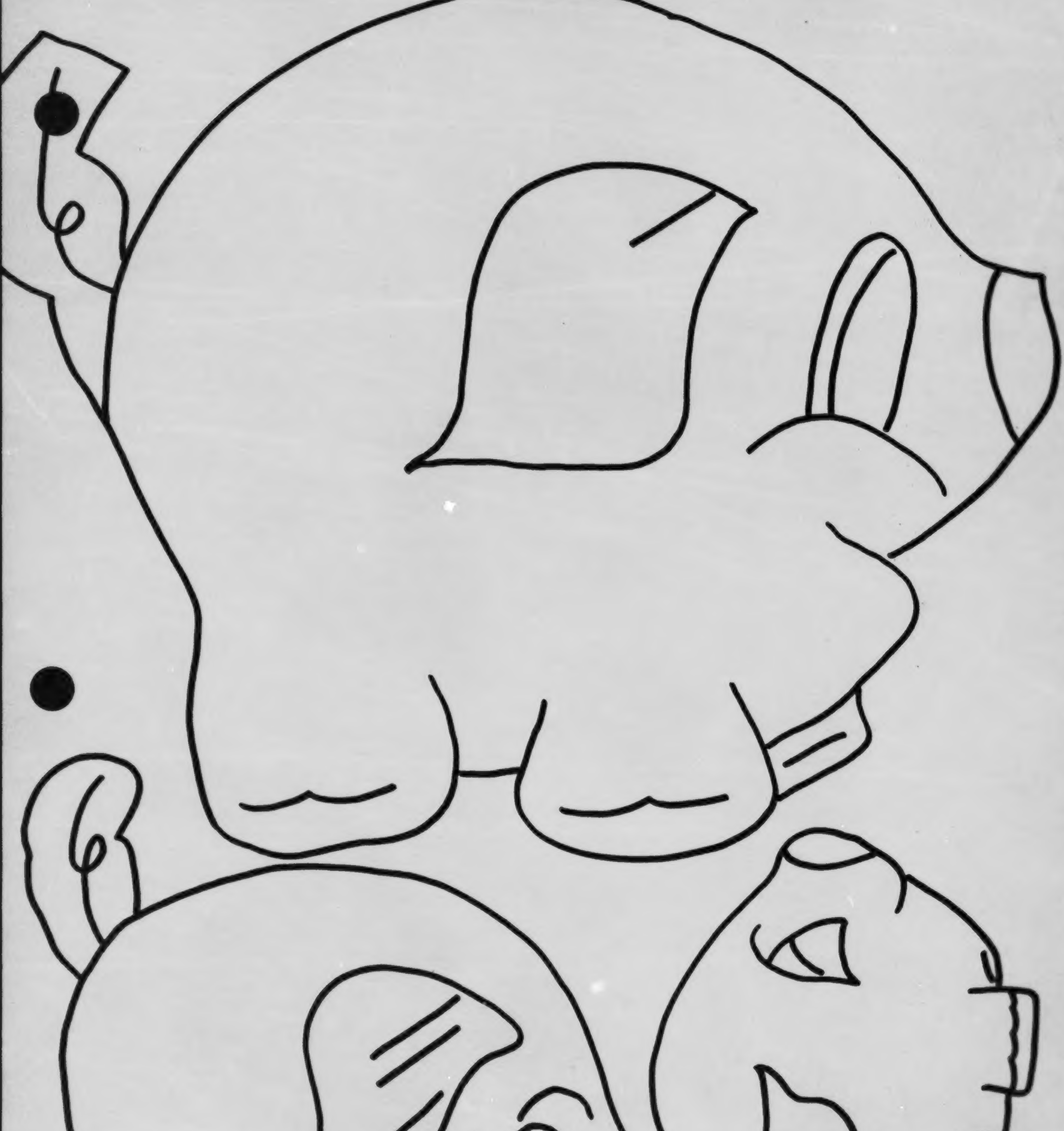
Willie, the big pig, explored in front of a bush, behind a bush, and inside a bush.
Tillie, the middle-sized pig, explored behind a tree, beside a tree, under a tree, to the left of a tree, and to the right of a tree.
Millie, the little pig, explored inside a mud puddle, outside a mud puddle, beside a mud puddle, and around a mud puddle.
And Millie said,
"I must find my brother and sister.
There are two others."

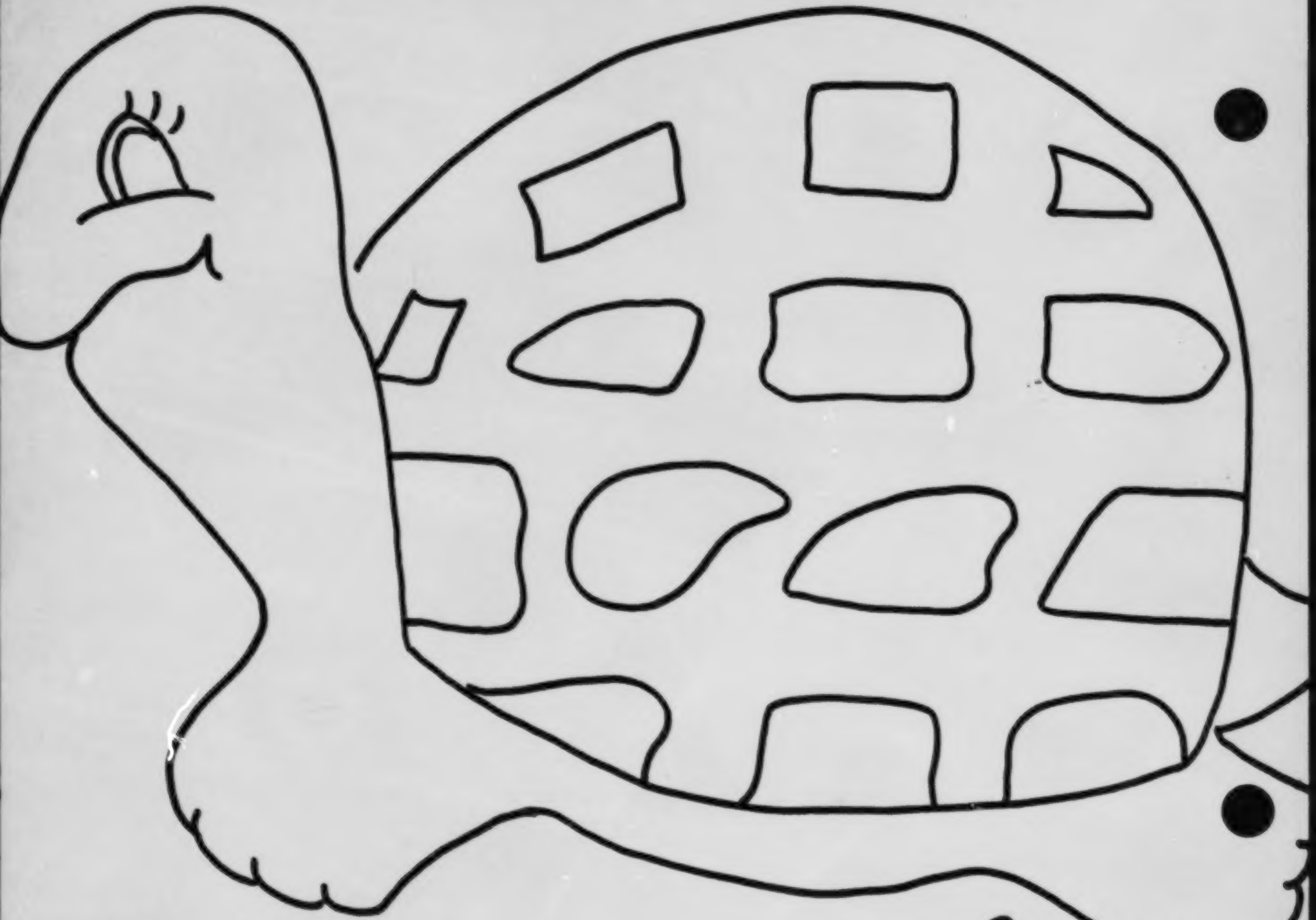
So Millie cleaned the mud off herself and trotted off and found Tillie, the middle-sized pig. And the two pigs said,
"We must find our brother.
There is one other."

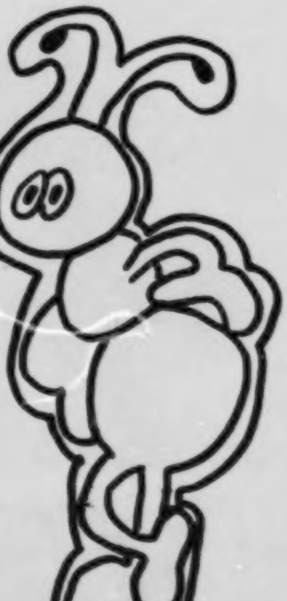
So off they went to find Willie, the big pig, who was sitting beside the bush. Willie joined his two sisters, and the three pigs trotted off to find their mother, who was quite worried. She thought they were naughty to be gone so long. She said,

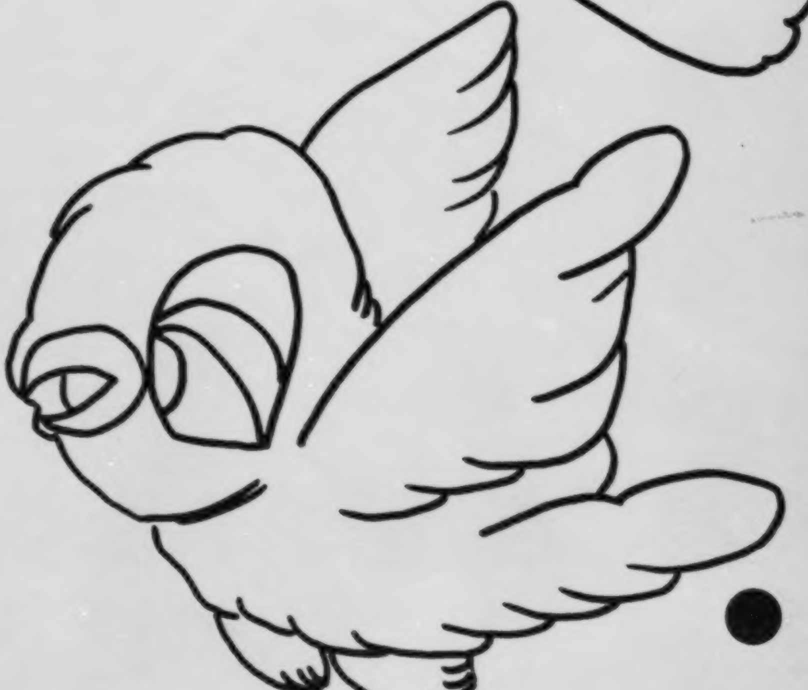
"Line up in a row,
1, 2, and 3.
You three naughty piggies,
Come and follow me."

Mother Pig, who was very large, went first. Willie followed second. Tillie followed third. And Millie was the fourth. She was behind Tillie. Millie was last. And very large Mother Pig led her three pigs to the pig pen which was lined with clean straw, and there they all lay down for a quiet snooze in the warm sun.





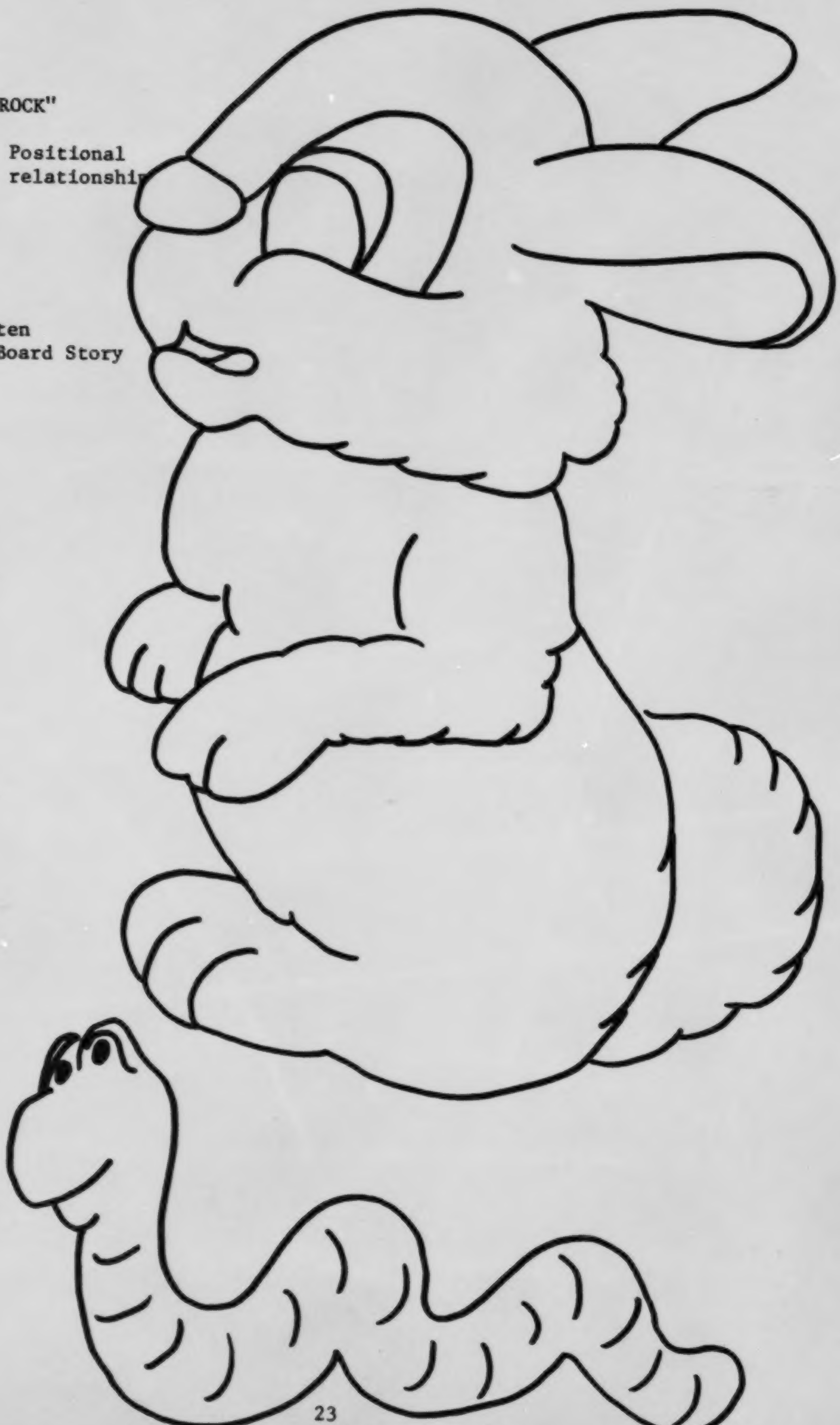


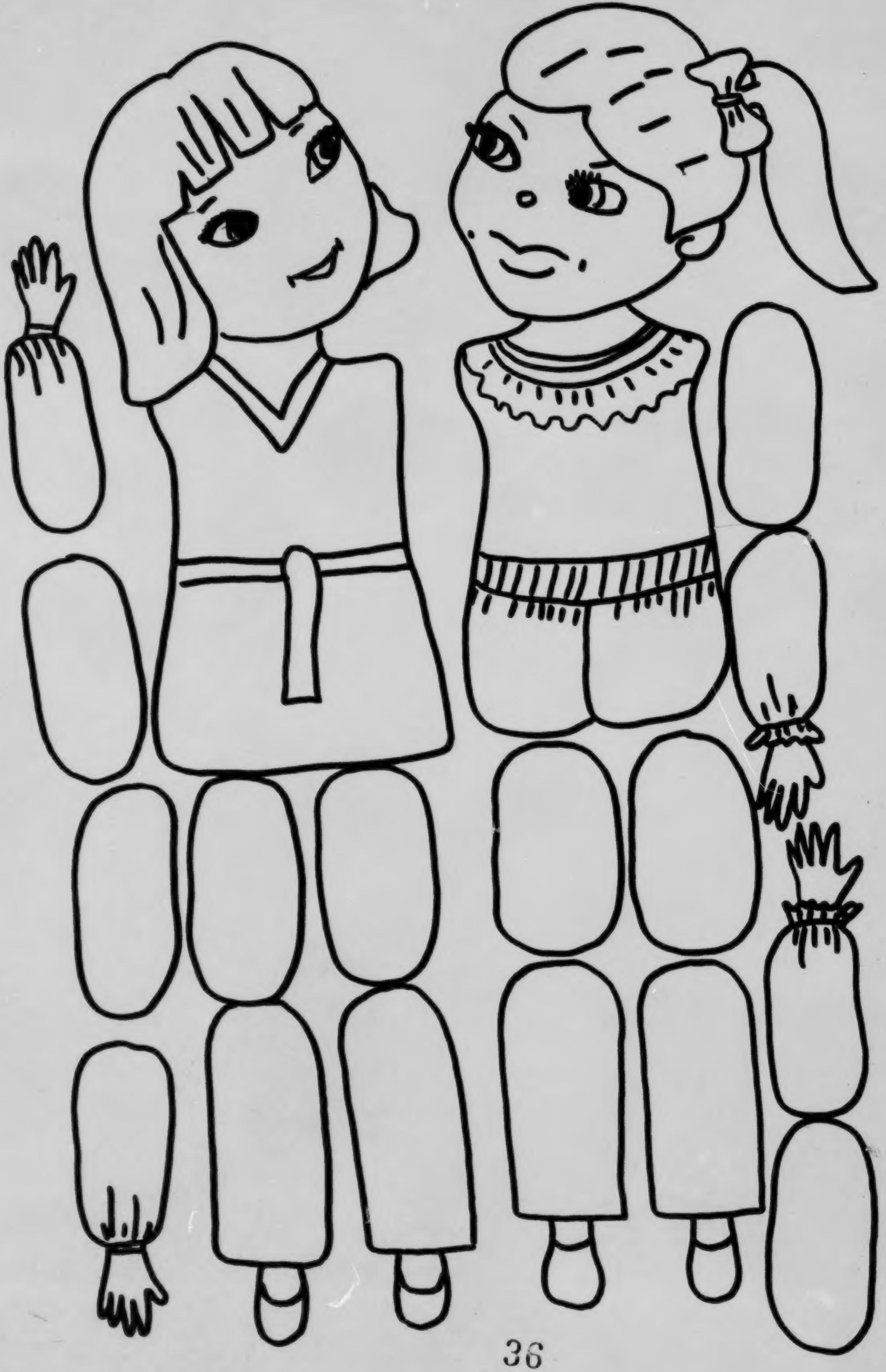


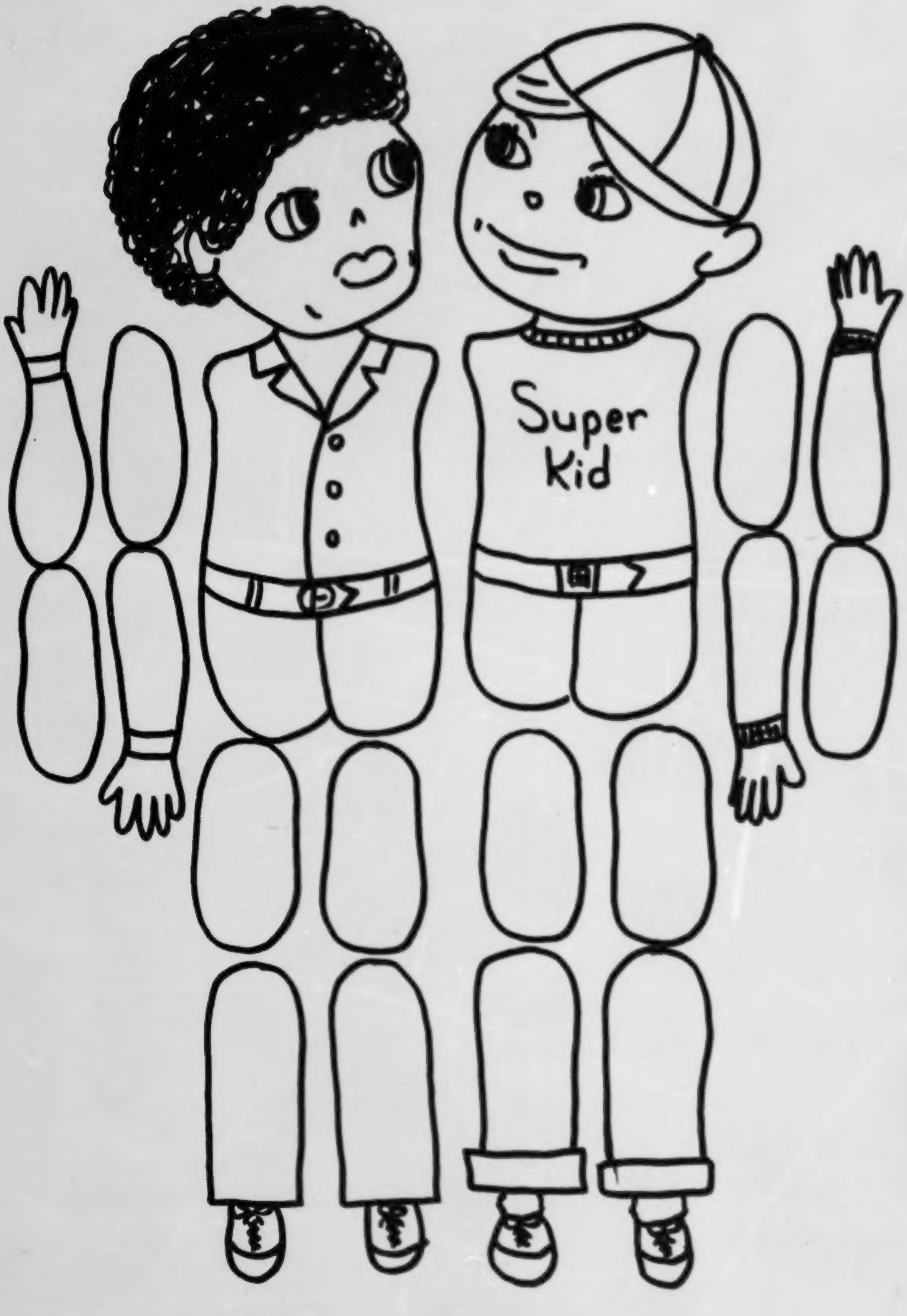
THE BIG ROCK"

CONCEPT: Positional
relationshi

Kindergarten
Flannel Board Story






Super
Kid

Put the balloon high on the wall.

Put the flower low on the floor.

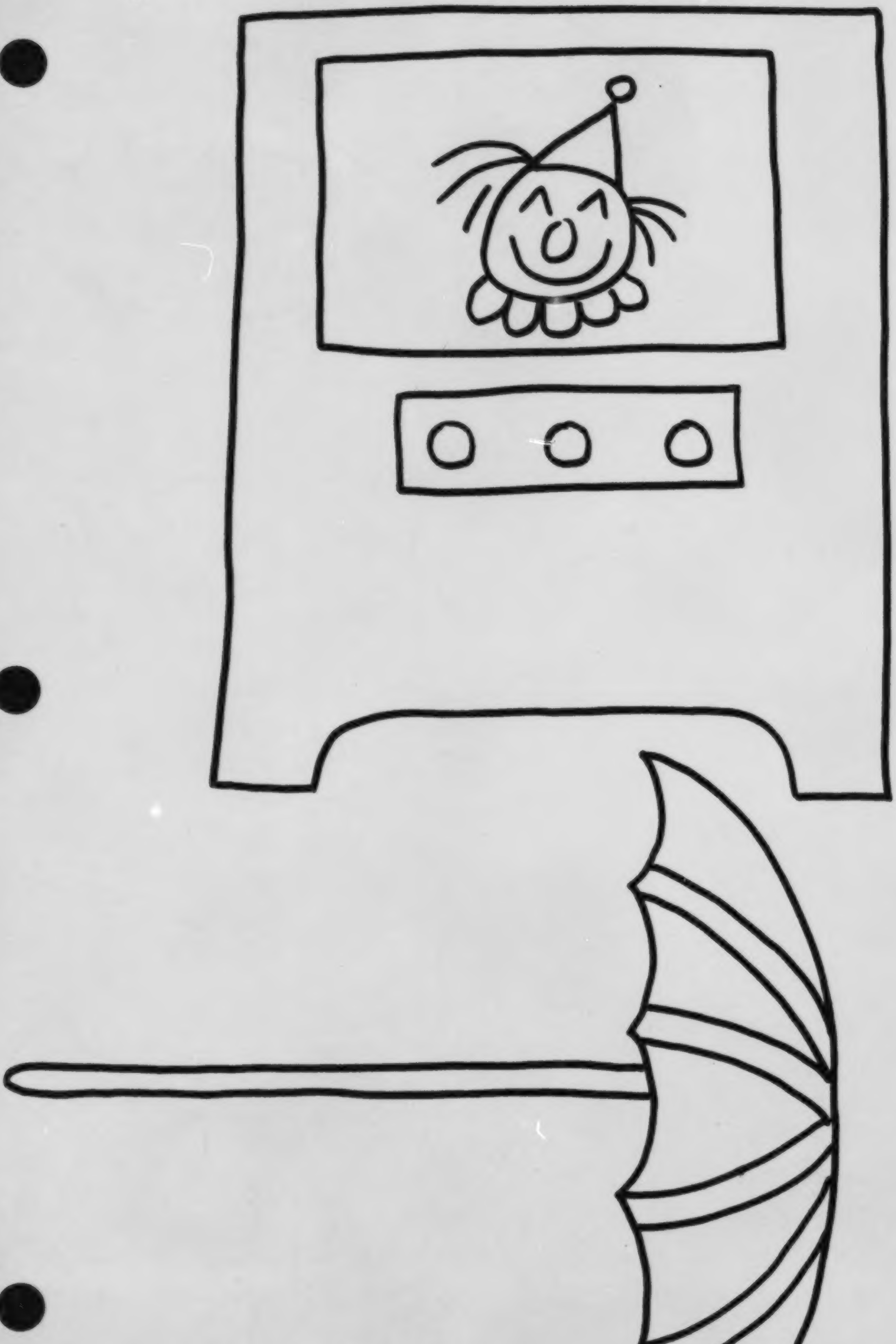
Put the football high in the air.

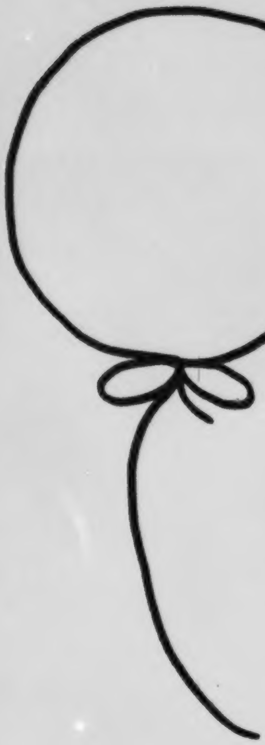
Put the letter on the television.

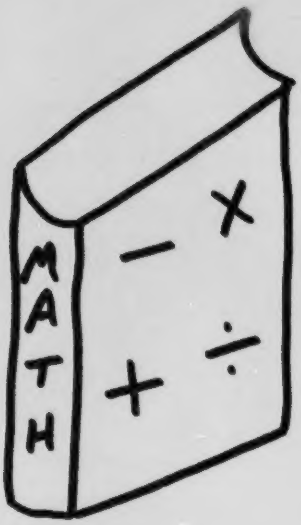
Put the cup in front of the stop sign.

Put the umbrella above the ice cream cone.

Put the book on the television.



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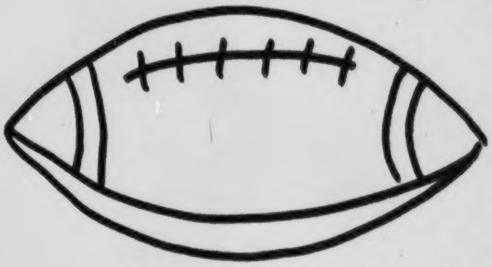
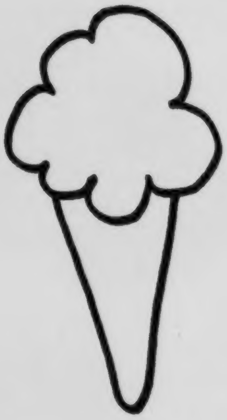
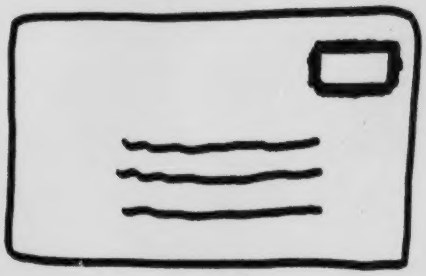
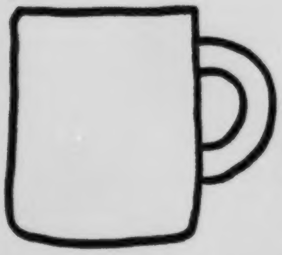
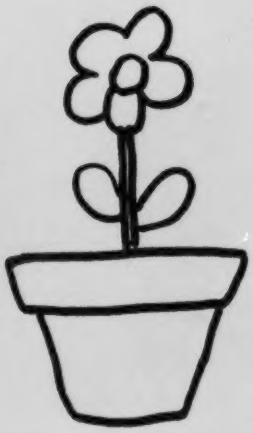
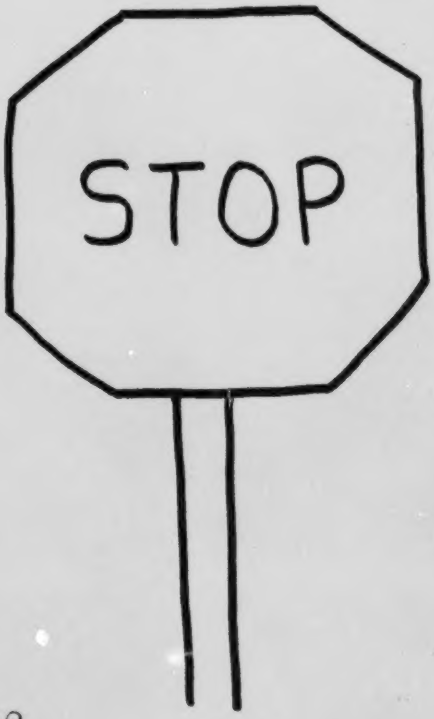











STOP

PATTERNING
(Order and Number Comparisons)

Introduction

Before, after and between are important mathematical terms. They can, however, be used in conjunction with non-number activities. The first few pages of this section are concerned with forming patterns (a non-number activity), where these terms can be introduced.

The order of the whole numbers used in counting emerges naturally from work with sets. Beginning with the empty set, one member at a time is added (or joined). The cardinal numbers of the respective sets formed are a natural sequence of the whole numbers, each number being one greater than that in the previous set. Therefore, it is important to work with ordering sets before talking about the ordering of numerals.

CONCEPT: Order - patterns

Equipment:

Colored blocks
Discs
Beads
Strings for the beads

Activity:

The class is divided into three groups, with one group getting blocks, another discs, and the third group getting beads.

Each group works on a pattern of "two" (use two different colored beads, blocks, or discs to form a pattern and then repeat it for two or more sequences). After the children have become proficient at working with a pattern of "two", they should begin working with "three". (Use three different colored objects to form a pattern.) The children can extend their knowledge of patterns to include using four, five, or more different colors and shapes to make sequences.

****

Equipment:

Magnetic board
Magnetic shapes

Activity:

A child is asked to form a pattern of "two" on the magnetic board, using two different shapes.

(e.g., ★ ○ ★ ○ ★ ○ ★ ○)

Another child may form a pattern of "three".

(e.g., ★ ○ △ ★ ○ △ ★ ○ △)

The children may also attempt a four or a five pattern.

****

Equipment:

Flannel board
Flannel shapes

Activity:

Individual flannel boards may be used, if available. If not, the demonstration flannel board can be used. The children are to form patterns as shown in the previous activity, using flannel shapes.

CONCEPT: Order - patterns

Equipment: Overhead projector

Activity: Each child forms a two, three or four symbol pattern on the overhead projector. Some symbol suggestions are:

○ △ □ ● etc.

Use the above activity with individual chalkboards.

****

CONCEPT: Order - sets

Equipment:

Paper plates
Boxes
Objects to set on the plates

Activity: The students will help the teacher form sets by placing a specified number of objects on the plates. First, they will help form a set having three members, then one with two members, then one with eight members, etc., until each of the ten plates has a set. A representative set for each number from one through ten should be formed. Ten boxes, each labeled with a numeral, should be placed on the teacher's desk in natural order. The numerals will face the students. The teacher then holds up a paper plate so that the objects on it can be seen by all the students. The children then tell into which box the objects must be emptied so that the number of objects matches the numeral on the box. This activity is continued until each set is in the appropriate box (in natural order).

Equipment

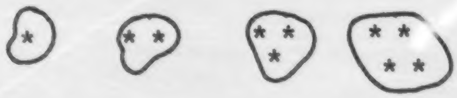
*************************** ******************

Equipment:

Magnetic board
Magnetic cards showing sets 0 - 10

Activity: The children arrange the set cards in natural order.

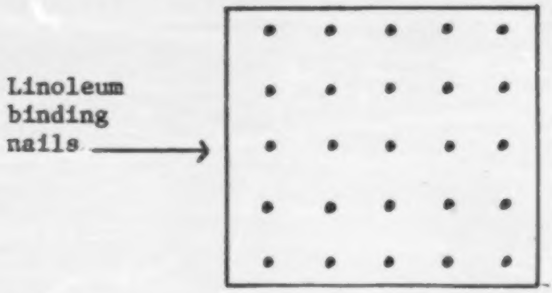
e.g.,



etc.

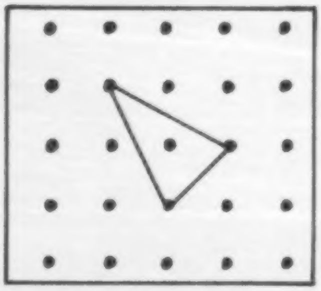
CONCEPT: Patterning

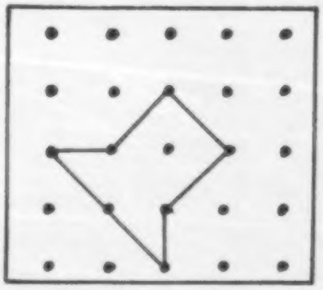
Equipment: Geoboards (Instructions for making them follow)

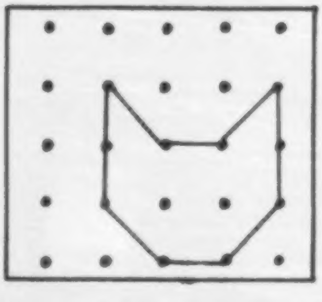


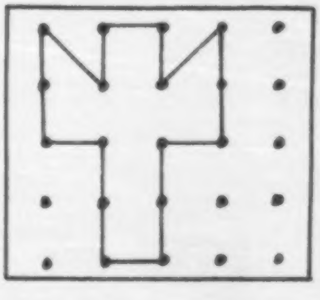
The geoboard can be made out of one-half inch plywood, using linoleum binding nails spaced one inch apart. It is a more attractive board if it is painted. The nails are pounded in so that approximately 3/8" of each nail is exposed. Different colored rubber bands should be used on the board.

Activity #1: Make a grid on a sheet of paper so there are five rows of five dots separated by one inch. This will match the nails on the geoboard. Make several patterns on these grids that students can copy on their geoboards. Below are some examples of patterns:









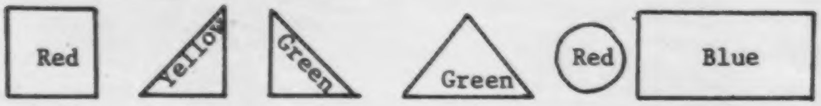
The child is given one of the patterns the teacher has made and also a geoboard with a rubber band. The child is to use the rubber band to make an identical pattern to the one on the grid.

Activity #2: An alternate activity would be to give the child a geoboard and a rubber band and ask him to make a design of his own. When he has done this, require him to make a copy of his design on one of the grids the teacher has given him.

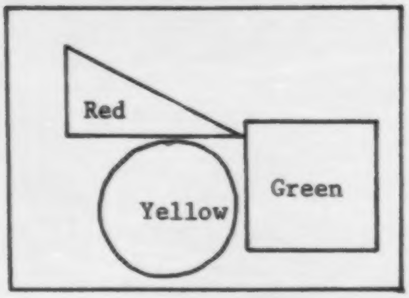
****

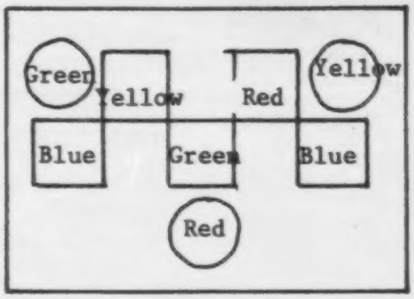
CONCEPT: Patterning

Equipment: Various flannel cut outs, using different sizes, colors, and shapes are prepared.


Red
Yellow
Green
Green
Red
Blue

Patterns are then made on 4" x 6" cards. Some examples are given below:

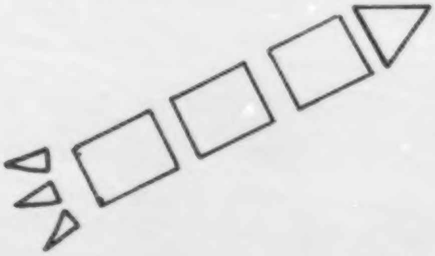

Red
Yellow
Green

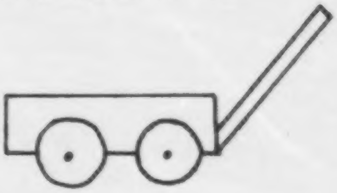

Green
Yellow
Red
Yellow
Blue
Green
Blue
Red

****

Activity #1: The child gets a flannel board and a tray of the flannel characters needed to make the pattern. He is required to duplicate the pattern shown on the card on his flannel board.

Interest can be increased by creating patterns that look like characters (animals, rockets, toys, etc.):



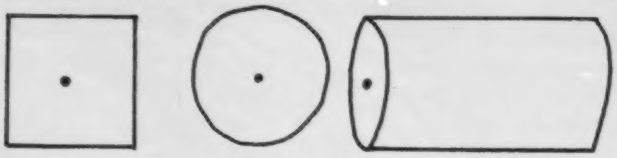


Activity #2: Another activity would be to allow the children to make their own patterns.

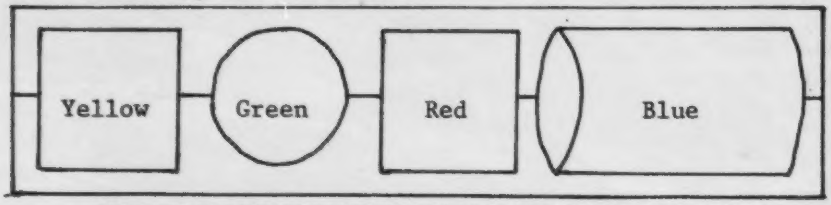
****

Equipment: String

Red, blue, purple, green orange and yellow beads of the following shapes:



The MIP prepares 4" x 6" cards, showing patterns as in the following illustration:



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Activity: The child gets one of the cards showing a pattern to be reproduced. He also receives a tray full of beads and a piece of string. He then makes the same pattern as seen on the card, using the beads and string he has been given. The pattern should be repeated at least twice. The teacher can then be sure the pupil understands the correct sequence of the beads. An alternate activity would be for the child to make up his own patterns.

****

Equipment: Unifix blocks

Activity: Visual

R B R B R B . . .

What comes next? Finish this pattern. Make a pattern like it using different colors.

G R R G R . . .

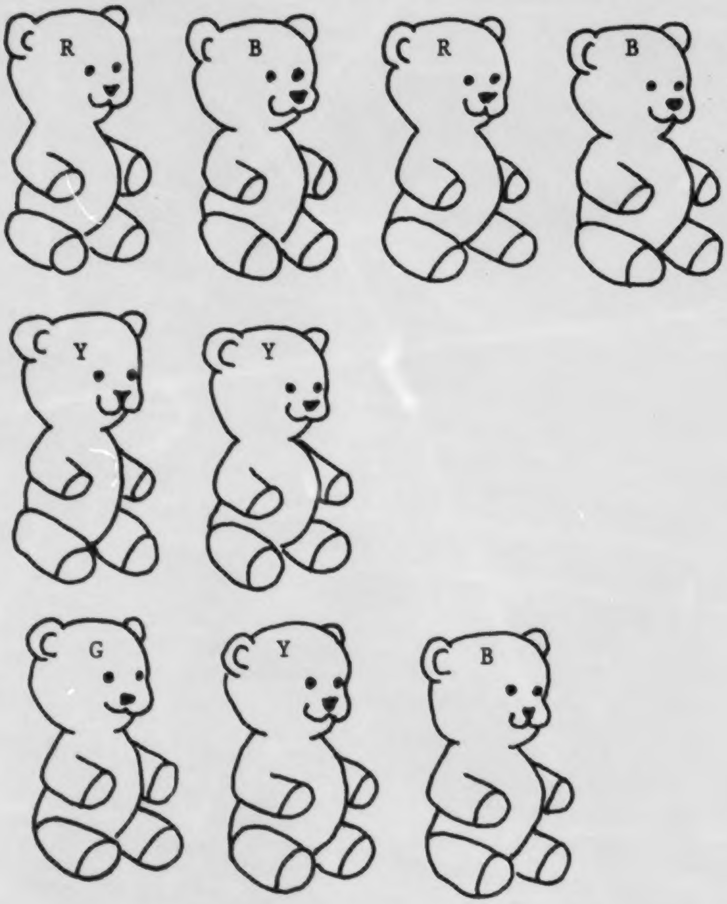
What comes next? Finish this pattern. Make a similar pattern using different colors.

CONCEPT: Patterning

Equipment: Teddy bears (red, yellow, blue and green)

Y - yellow
G - green
B - blue
R - red

Activity: The MIP prepares 8½" x 11" card index, showing teddy bear patterns as in the illustration following:



The child gets one of the cards showing the color and number pattern to be reproduced on the same line. He also receives a tray full of teddy bears. He then makes the same pattern as seen on the card. The pattern should be repeated at least twice.

COUNTING

INTRODUCTION

RATIONAL: Counting of Objects

ROTE: Counting should be deferred until the children are able to establish, with confidence, a number perception with respect to sets of objects (without counting). Some children may have learned to count using a rote, short cut method (being able to recite the number names in order). Children who count by rote need special encouragement to see the relationship between the number name and the number in a set. For example, a child who is learning to count objects (unlike an adult who counts) should say each number name after he has completed a move, and as he perceives the number of objects. He should arrange the objects that he moves in patterns, so that he and other children can readily perceive the number in successive sets (subsets of the entire set).

The child should be able to count, as follows:

Kindergarten	1 - 20 by ones
Grade one	1 - 100 by ones, twos, fives, tens
Grade two	1 - 100 by ones, twos, fives, tens

ERIAL: Rote counting is counting without the aid of objects. Rational counting is the counting of a set of objects. Serial counting is the counting of sensations as distinguished from the counting of objects. The auditory sense will be used in this form of counting. The teacher will make a set of sounds in some manner (hammer on wood, clapping of hands, tapping the table with a pencil, piano, etc.), then the students will state the number of sounds heard.

ORDINALS: Numbers are used not only to tell "how many" but also to indicate a position in an orderly arrangement of objects. Thus, if five objects in a row are counted from one end to the other, objects "one" and "five" are at the ends, and object "three" is in the middle. This is an ordinal use of the number names. Thus, the idea of position can be expressed without using the words first, second, third, etc. When one counts a group of objects, the final answer is the same, regardless of the order in which the objects are counted. However, when the number names are used to indicate order or position, the situation is quite different. In a row of five objects arranged in a horizontal line, the object that is "two" from the left will be "four" if the objects are counted from right to left. In this situation, the word "five" is used to tell not only how many objects there are (the cardinal use), but also which object is last in this arrangement (the ordinal or positional use). Children need careful instruction and experience in using number words to tell position. They must become aware that position is relative to the starting point and to the direction in which the "count" is made. The teacher must make certain that the reference point for ordering is at the left, since at this stage of development students are beginning to read (from left to right) and will find it difficult to work from right to left.

CONCEPT: Rational counting

Equipment: Children

Activity: All boys present should stand. Several different girls may then count the boys. The girls will stand and the boys will count them. This can be a daily activity.

****

Equipment: Counters (discs, blocks, buttons, sticks, etc.)

Activity: Each child has a set to count. The number of elements in this set will vary according to the maturity of the child. The children are asked to count the number of elements in the set. They should know that when they count, the number stated represents the cardinal number of the set of objects counted thus far. Several lessons should be carried out, using different counters and varying the number of elements in the sets.

****

Equipment: Paper bags
Objects to place in the bags

Activity: The students are given paper bags containing six through ten objects. They are to determine the number of items in their bags and are not to tell anyone the number. One student then comes to the front of the class, shakes his bag, and asks the class to guess the number of objects it contains (by giving hints of "more than" or "fewer than" after each guess). The student who guesses correctly wins. He may then count the objects as he takes them, one by one, out of the bag; he then lets the class try to guess the number of objects in his bag.

CONCEPT: Rational counting

Equipment: Cards showing sets (1-20 elements)

Activity: Each child is given one of the cards. The MIP then has an option of several activities:

1. The MIP will say a number of all the children having that many elements in their sets will stand up. The teacher then checks to see if they are correct.

2. Each child stands up, one at a time, and counts (aloud) the elements in his set, stating the cardinal number of the set counted.

3. A card showing a numeral is flashed to the class. All the children having sets where the cardinal number is this numeral should stand up. The MIP checks those who are standing for correctness.

This procedure may be repeated by collecting the cards, mixing them up, and redistributing them.

****

CONCEPT: Rational counting - beginning with a certain number

Equipment: Sets of seven through ten objects for each student

Activity: Each student receives a set of seven through ten objects. He is asked to arrange them on his desk so that members of the set do not touch. The students group three members of the set (without moving any of the objects) and count the rest of the set. Then, four objects are grouped, and the rest of the set is counted, beginning with the number four. This process is continued until the students realize that the objects in the smaller group (subset) do not have to be counted, and that they can begin to count with the number associated with the subset.

****

NOTE: For rational counting by twos and fives, use the same objects and activities you used for counting by ones.

CONCEPT: Serial counting to ten

Equipment: Ball

Activity: The ball is bounced a predetermined number of times (out of the view of the class). One student tells how many times the ball was bounced. This can be repeated by bouncing the ball a different number of times.

****

Equipment: None

Activity: The children will close their eyes. The MIP claps his hands together a predetermined number of times. The children then open their eyes and someone tells how many times the MIP clapped his hands. Other methods for making sounds can be used: stomping the foot, tapping the desk, etc.

****

Equipment: Hammer
Block of wood

Activity: The children close their eyes while the MIP hammers the block of wood. They must then tell how many times the hammer strikes the block of wood.

****

Equipment: Metal triangle
Metal rod

Activity: The children close their eyes, while the MIP strikes the triangle several times. They must then tell how many times the triangle was struck.

****

Equipment: Bells

Activity: The children close their eyes while the MIP rings the bells. They must tell how many times the bells were rung.

CONCEPT: Serial Counting

Equipment: Tactile box
Wooden blocks

Activity: Place up to ten blocks in the tactile box. The children place their hands inside the box to determine the number of objects by using their sense of touch.

****

CONCEPT: Ordinals

Equipment:	Children
Activity:	The class is divided into the set of boys and the set of girls. The boys are lined up in a row, while the girls are asked questions about the boys, relative to their positions. Some of the questions are listed below: Which boy is last? Which boy is first? Who is in the fourth position? Who is second? etc. The boys then sit down and the girls form a row, while the boys answer questions about the girls.

****

Equipment:	Toys, cars
Activity:	The cars are arranged as if they're in a race. The teacher points to different cars, questioning the children about their positions. The children should also be asked questions where they have to identify cars that occupy certain positions.

CONCEPT: Ordinals

Equipment: Chairs

Activity: Several chairs are placed in front of the children. The teacher and class then talk about the position that each chair occupies. The chairs can even be marked with the numerals 1, 2, 3, 4, 5, etc. (E.g., Mark, sit on the third chair.") Other directions may then be given:

1. "Will the child in the first chair please stand up?"
2. "The child in the sixth chair will return to his desk."

****

Equipment: Flannel board
Several felt birds of different colors

Activity: The birds are placed on the flannel board as if they were flying in a race. The MIP points to different birds and questions the children as to their relative positions. Questions similar to the following may be asked:

1. "In what position is the red bird?"
2. "In what position is the green bird?"
3. "What color is the bird in the third position?"
4. "What color is the bird in the sixth position?"

****

Equipment: Magnetic board
Magnetic objects

Activity: The objects are arranged in a row so it is obvious which one is first. The MIP picks up different objects and asks the class about their relative positions. A child may also go to the board and pick up objects named by the MIP (with reference to their positions).

****

Equipment: Overhead projector
Objects, or pennies

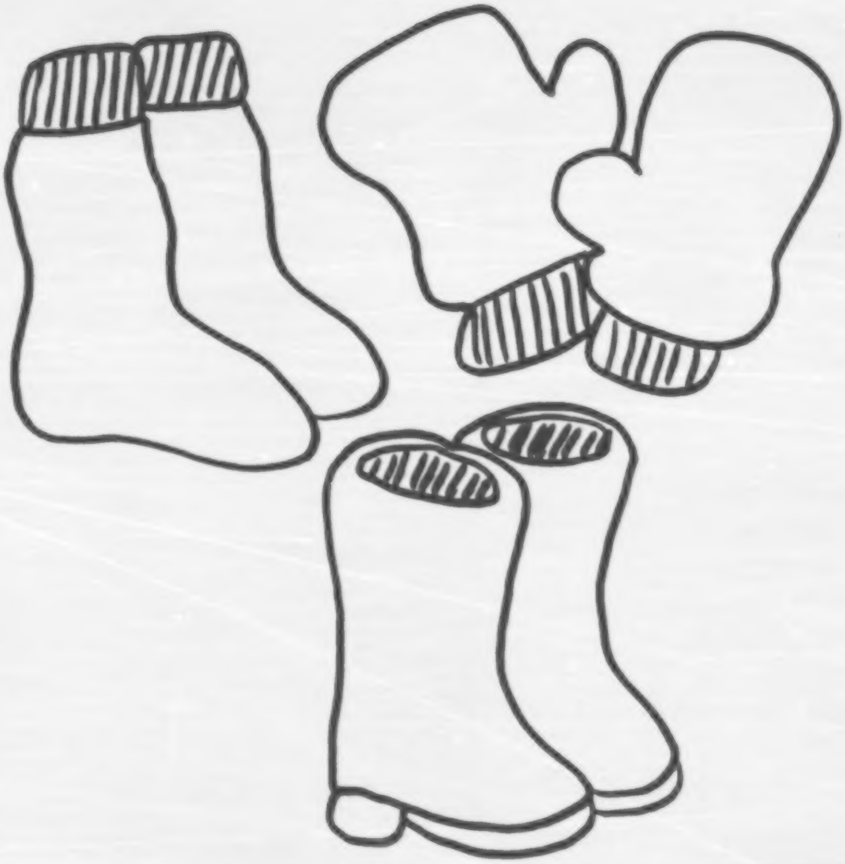
Activity: The objects, or pennies, are arranged in a row on the overhead projector. The MIP must designate which object is first and in what directions the children will count. Such questions as the following may be asked:

1. "Which object is in the third position?"
2. "Which object is last?"
3. "In what position is this object?"

REINFORCEMENT ACTIVITIES

CONCEPT: Counting by 2's

Equipment:	Cards
Activity:	Make a set of cards with pairs of objects on each card. One child starts the counting by 2's till the MIP instructs them to stop. The next student picks up where first student stopped and on around the circle until all students have counted, then repeat procedure.



COUNTING BY 2'S

Use different leugths of plastic chain. (Change colors every "2".) Write each child's name on blackboard and record his or her score under his name. The child with the highest (or lowest) score wins and puts a magnetic object under his name. At the end of class, the one with the most objects is the "grand winner."

(This could be used for Counting by 5's or 10's also.)

REINFORCEMENT ACTIVITIES

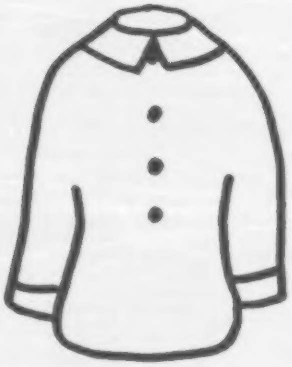
Clothesline - pants & shirts

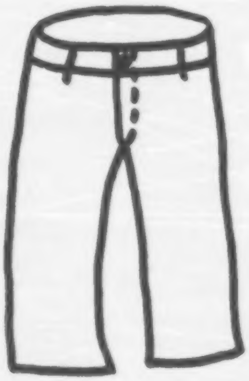
CONCEPT: Counting

Equipment: Construction paper
Magic Marker

Activity: Cut out ten shirts and ten pants. Write the numbers on the outfits: shirt (1), pants (2), shirt (3), etc. (4).

Let students hand on string or wire holder.





Money - or Counting by 5's

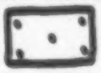
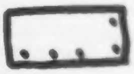
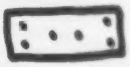
Place magnetic items on board with a price above each one. Children may then pick out and purchase items with paper money.

For Counting by 5's--each child rolled a numbered cube and was given that number of nickels--counting total each time. They had the option of buying an item they could afford or saving for a more expensive one. (The items were all priced in 5's.) This could also be used for Counting by 10's.

SET RECOGNITION

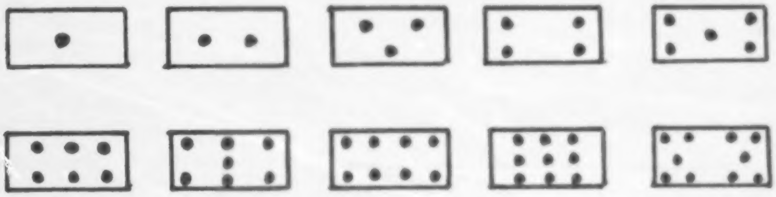
Introduction

One-to-one matching is the basis for the mental process through which a child learns the cardinal numbers of sets. For example, he may see a set of three objects, but not be aware of the number for this set. The next time he sees a set containing this number of elements, he matches (consciously at first, then later unconsciously) this set with the set whose number he knows, and concludes that the new set also contains three elements.

The child should learn to recognize the number of elements in a set, as a group, without counting. In the beginning, some children may need to count the elements, but there should be constant encouragement to recognize the number of a set without counting. By arranging the elements in easily recognizable patterns, the children can be helped to recognize sets with counting. For example, it is easier to recognize five  from this pattern, than from this one  . Most people would recognize the following pattern  as a single set of six, but some may see it as sets of four and two, while others will see two sets of three. Seeing a set of six in two parts (subsets) is a natural preparation for the addition equations, 4 + 2 = 6 and 3 + 3 = 6.

The child should learn to recognize immediately, without counting, groups of two, three, four, and five objects. The child's understanding of these small groups will enable him later to break up and identify larger groups. Moreover, research and experience have shown that children understand arithmetic better, and can reach high levels of achievement, when they are taught to recognize and use groups.

The basic configurations used for one through ten objects will be as follows:



CONCEPT: Empty Set

Equipment:
Children
Chairs

Activity: Four boys are placed in four chairs in front of the class. The class is then asked to describe the set of boys. Two boys are told to go back to their seats. The class now describes the new set of boys. The remaining two boys are told to take their seats. The class then describes the set of boys remaining.

****

Equipment:
Dish
Blocks

Activity: A dish which contains five blocks is placed in front of the class. The teacher asks the class to tell how many blocks are then removed. The children describe the new set of blocks. The last three blocks are removed from the dish, and the children describe the set of blocks that now remains.

****

Equipment: A container with several counters in it

Activity: Objects are removed, one by one, from the container. Each time this is done, the students should feel the inside of the container to see if there are any objects left. They are then asked to describe the set that is in the container. At the end of this sequence of activity, the last remaining object is removed. The students are allowed to place their hands in the container to "feel" the absence of members. They are told, "This is a set with no members. It is the empty set."

****

Equipment: Assorted objects (e.g., bottle caps, blocks, discs, sticks, etc.)

Activity: The students are asked to construct a set of all the bottle caps on their desks. Then they will construct a set of all the blocks on their desks. This process is continued for three or four types of sets. The students are then asked to construct the set of elephants on their desks. (The set of elephants is an example of the empty set.) The Mathematics Instructional Paraprofessional should say, "Since there are no elephants on your desks, there can't be anything in the set of elephants on your desks. This is an empty set."

CONCEPT: Empty set

Equipment: None

Activity: Each child who belongs to the set of all the children in the classroom is asked to stand. Then the Mathematics Instructional Paraprofessional asks that only the students with black hair remain standing; Next, he/she asks only those who are girls with black hair to remain standing. This process is continued until no students are left. Finally, the Mathematics Instructional Paraprofessional asks which members are in a certain specified set. (E.g., "Who belongs in the set of students with black hair? Who belongs in the set of girls with pink ribbons in their hair? Who belongs in the set of people with three ears?" The ears of several students can be counted to indicate the process used to determine whether there are members of this set. Since there are no students in this set, it is the empty set.)

****

Equipment: Flannel board
Flannel board stars, squares, ducks, and moons (two of each object is sufficient)

Activity: The class is asked to construct a certain set (e.g., a set of ducks). A series of flannel board objects is held up so that the class can determine whether the object belongs in the set being constructed. After four or five sets are constructed in this manner, the class should be asked to construct the set of dogs. One object at a time is held up and the children are asked whether or not the object should go into the set. When all the objects have been viewed, the Mathematics Instructional Paraprofessional asks the students, "What do we call the set of dogs?" Hopefully, the answer will be, "The empty set, since there are no members in the set of dogs on the flannel board."

CONCEPT: Empty set

Equipment: None

Activity: The children are asked to determine which of the following are examples of the empty set:

1. The set of girls in the classroom who have red hair.
2. The set of pupils in the class who are over forty years old.
3. The set of girls in the class.
4. The set of boys in the class.
5. The set of people in the classroom who are over twenty years old.
6. The set of people in the school who have green hair.
7. The set of children with two heads.
8. The set of children in the class.

****

Equipment: Individual chalkboards

Activity: The students are to draw a set of four objects on their chalkboards. One child is asked to give the cardinal number of this set. The students then erase one object at a time, naming the new cardinal number each time. When there are no objects remaining in the set, the MIP asks, "What kind of set do we now have?" Someone may describe the cardinal number of this set.

****

Equipment: Overhead projector
Objects

Activity: This activity is similar to the preceeding one. One object at a time is removed until none remain. The children should describe the set each time one member is removed, until the last response becomes, "The empty set."

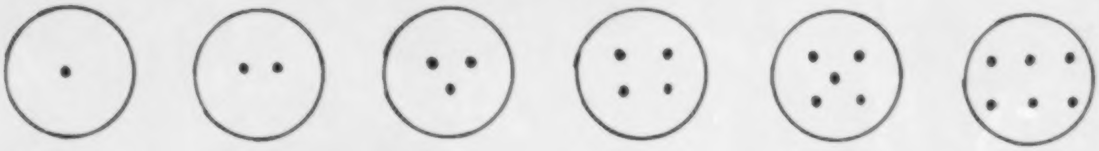
CONCEPT: Primary group recognition

Equipment: Blocks, bottles, sticks, etc.

Activity: Sets of two, three, four, and five objects are shown to the children. They should be able to state the cardinal number of the set without counting. Several different objects can be used to form the sets, so the children will have the advantage of different experiences.

****

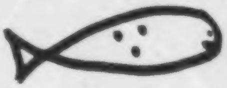
Equipment: A large circle drawn on the floor
Circles cut out from construction paper (showing the sets, one through six)



Activity: The circles containing the sets are placed inside the large circle to act as stepping stones, while the large circle represents a pond. Each child tries to walk across the pond on the stepping stones. He may step on the next stone, if he can identify the cardinal number of the set on it. If he misses the number, he falls in the pond and has to return to the bank.

CONCEPT: Set recognition

Equipment: Several fish cut out of construction paper (with one of of the basic configurations on each one, and a paper clip for its mouth)
Pole
String with small magnet on the end



Activity: A large circle, that will serve as a pond, is drawn on the floor. The fish are placed in the pond. Using the pole, with the magnet acting as a hook, the children are able to catch the fish by bringing the magnet into contact with the paper clip. They must identify by cardinal number of the set without counting. This activity can be repeated many times.

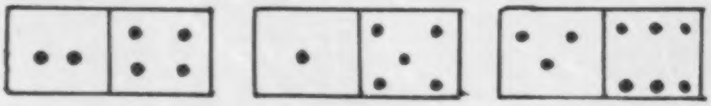
****

Equipment: Overhead projector
Various shapes to show images on the screen (e.g., pennies rabbits, pumpkins, snowmen, etc.)
Sheet of construction paper

Activity: One of the basic patterns (•, • •, ∴, ∷) ⁙ is formed on the overhead projector, and the image is blocked with a sheet of construction paper. The sheet of paper is raised just long enough to give the class time to visualize the set but not long enough to count the members. The children then tell the number of members they observed in each pattern.

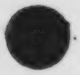
****

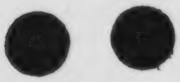
Equipment: Flash cards showing patterns similar to dominoes:

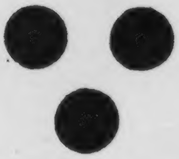


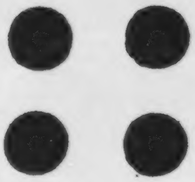
Activity: One half of the card is covered by the teacher's hand, the other half is exposed to the children. The children are required to identify the number of dots on the card without counting. The other side of the card can then be covered, while exposing the one previously covered. This set should also be identifyed.

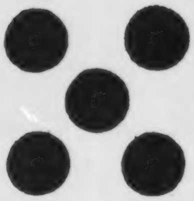
SET CONFIGURATIONS

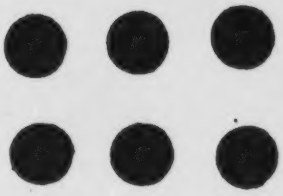


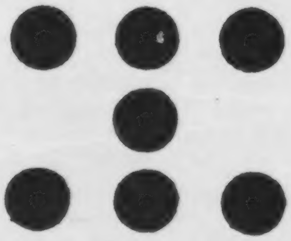


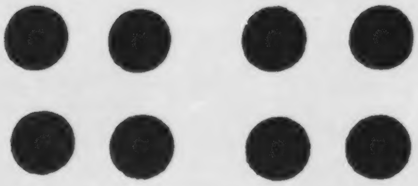


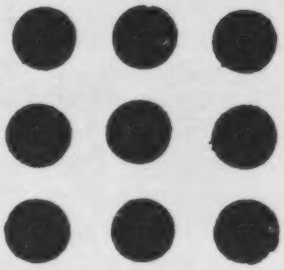


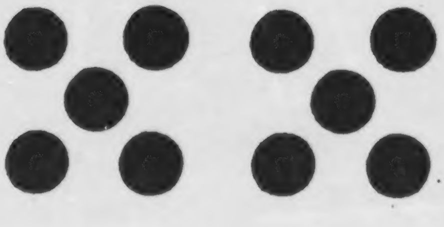






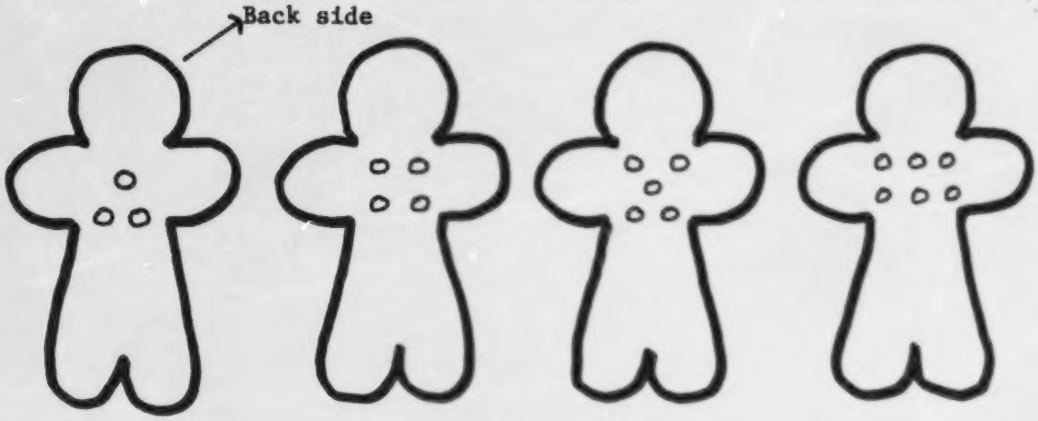


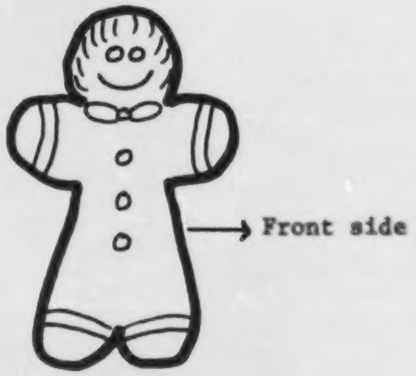




CONCEPT: Set recognition

Equipment:	Several gingerbread people cut out of card index (with one of the basic configurations on each one on the back side
Activity:	Deal out to each child, just as you do for a card game. Each child will tell the set on his/her gingerbread person, if correctly identified. Discard in the middle of the table. The child who depletes his stack first is the first place winner. This activity can be repeated many times.

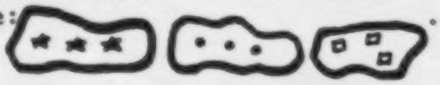




ONE TO ONE MATCHING

Introduction

One of the most basic concepts in mathematics is that of a set. Sets and set relationships form an integral part of the entire range of mathematical development. Intuitively, a set is simply a group, or collection of objects. Any collection of objects that can be placed together, treated together, or thought of together can be considered as a set. The objects that form a set are called its elements or members. The essential characteristic of a set is that it be well-defined. This means that it should be possible to tell which objects are in the set.

The cardinal number of a set is the property of the set which tells how many objects it contains. The cardinal number of each of the following sets is three: . The property these sets have in common is their "threeness". All sets containing three objects belong to the equivalence class named by the cardinal number, 3. No one can show all the sets in an equivalence class. Therefore, any set in the equivalence class can be chosen as a representative of the entire class, since it is typical with regard to number property, and may be matched one-to-one with any set in its class.

EQUIVALENT SETS

This concept is of great importance because it is the basis of showing that sets with the same number of elements (equivalent sets) can be designated by the same numeral. Students can determine whether or not two sets are equivalent by developing a scheme for pairing up the elements of the sets. If the elements of the two sets can be paired, with no remaining elements in either set, then the sets are equivalent.

When two sets are paired in this manner, it is also true that a one-to-one correspondence exists between the two sets. Therefore, two sets that can be placed in a one-to-one correspondence are equivalent. The order in which objects of two sets are matched is not important.

The phrases "as many as", "equal to", and "same number" may be introduced at this stage of mathematical learning, instead of using the term equivalent. When matching sets, connecting lines should be short. Students often have difficulty following or tracing a long path.

CONCEPT: One-to-one matching

Equipment: Counters (blocks, sticks, discs, etc.)

Activity: The MIP forms a set of blocks (counters) that has the same cardinal number as there are children present in the class. To determine if there are the same number of blocks as there are children, each child must pick up a block. If all blocks are picked up, and every child has one, then the set of children and the set of counters are equivalent.

This activity can be repeated for a set of girls and a set of boys.

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Equipment: Counters (blocks, sticks, discs, bottle caps, etc.)

Activity: The MIP forms two sets of counters that contain the same number of elements. He/she then discusses with the children the ways of determining whether they contain the same number of elements. (Some children will suggest counting. Hopefully, someone will suggest some form of matching.) A matching scheme should then be used to find out if the sets are equivalent. (They are if every counter has a partner.)

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Equipment: Individual flannel boards
Flannel objects

Activity: Each child is given an even number of objects. The objects are then separated into two equivalent sets. The equivalence should be determined in the following manner: The MIP says to the children, "Using your hands, remove an element from each set. Continue removing one element at a time until all elements are gone from one or both sets. If all the elements are gone from both sets, the sets are equal to each other."

CONCEPT: One-to-one matching

Equipment: Overhead projector
Flannel shapes
Pennies, etc.

Activity: Two sets are again formed on the overhead projector. The children can see whether they have the same number of elements as the MIP removes objects from the sets (one at a time from each set). If all elements are removed, the two sets are equivalent.

This activity should be repeated with different sets; some equivalent, some not.

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CONCEPT: One-to-one matching - equivalent sets

Equipment: Chalkboard or individual chalkboard

Activity: The children (either at the chalkboard or on individual chalkboards) form two sets that contain the same number of elements. Equivalence is determined by pairing the elements of the two sets, one-to-one.

ere is an idea for a flannel board activity which I like to use to teach one-to-one matching. It is taken from Grade Teacher.

Annette Van Blaricum
Waco Kdg. FT

Mrs. Goose's Party

Mrs. Goose had many friends, who often brought a treat, or invited
her to their house, for something good to eat.

Then came a day when Mrs. Goose saw not a single friend, from morning
until noon-time, and until the day's last end.

She finally heard they'd gone to school. "Please come too," said Mrs.
Hen. "We sing and read, and each of us has learned to count to ten."

Mrs. Goose just stretched and yawned. "Who needs to learn all that?"
Her neighbors waved and said good-bye. Mrs. Goose just rocked and sat.

"I don't need school," cried Mrs. Goose. "I know all I need to know.
I don't want to learn to count. I just don't want to go!"

But Mrs. Goose grew lonesome, as she watched the others go. She said,
They never visit now. What can I do? --- I know!"

"I think I'll have a party. I'll have it here tonight, and all my
friends who go to school are the ones I will invite."

"How can I tell how many chairs I need to have in place? Why, I'll
just think of all my friends, and get one for each face."

(Place characters on the flannel board)
"I must invite nice Mrs. Hen, and also Mr. Horse; then Mrs. Cow and
Mrs. Pig, and Mr. Dog, of course."

"The hen is one, the horse is two, the cow will make one more:
counting the dog and then the pig, I think that will make four....

Or is it five, or maybe six? I wish I could be sure just how many
there will be---(Remove characters). Is it less, or more?"

(Place chairs on flannel board)
"I'll put my red chair and my blue, and put two green ones near so
I can reach them quickly when all my guests are here.

Now, I think my chairs are ready, so each guest may have a seat.
The next thing that I must decide is what to have to eat.

f I just knew how many that I would need to make, then I could
serve to everyone, a tiny frosted cake.

No, I'd better just serve ice cream, when my guests come in the door;
I'll serve big scoops if they are few, and small if they are more."

Mrs. Goose started getting ready, and as she did, she sang. Then when
it was party time, her front doorbell rang.

(Place the following characters on chairs, in order)

Mrs. Hen sat in the red, Mr. Horse sat in the blue; the dog
and pig then chose the green. Remember? There were two.

(Place Mrs. Cow on the board)

Mrs. Cow looked all around, but there wasn't any more, so she just
folded up her legs, and sat down on the floor.

"My dear good friends," said Mrs. Goose. "I'm so glad that you could
come. I have some homemade ice cream, and wish to serve you some."

(Put bowls in a row at one side of the board)

Then she scooped up the ice cream, filled the blue dish and the red;
next, she filled two green bowls, and an extra dish, then said:
"Now I think I have it right--one dish to match each chair, with an
extra one for Mrs. Cow, who is just sitting there."

(Place ice cream on the bowls)

"My friends are but a few," she said. "Three, or two, or four."
So she scooped up the ice cream until there wasn't any more.

(Put bowls by characters)

She gave a bowl to everyone, then looked for hers. to see the ice
cream freezer empty. "Why, there's no ice cream for me."

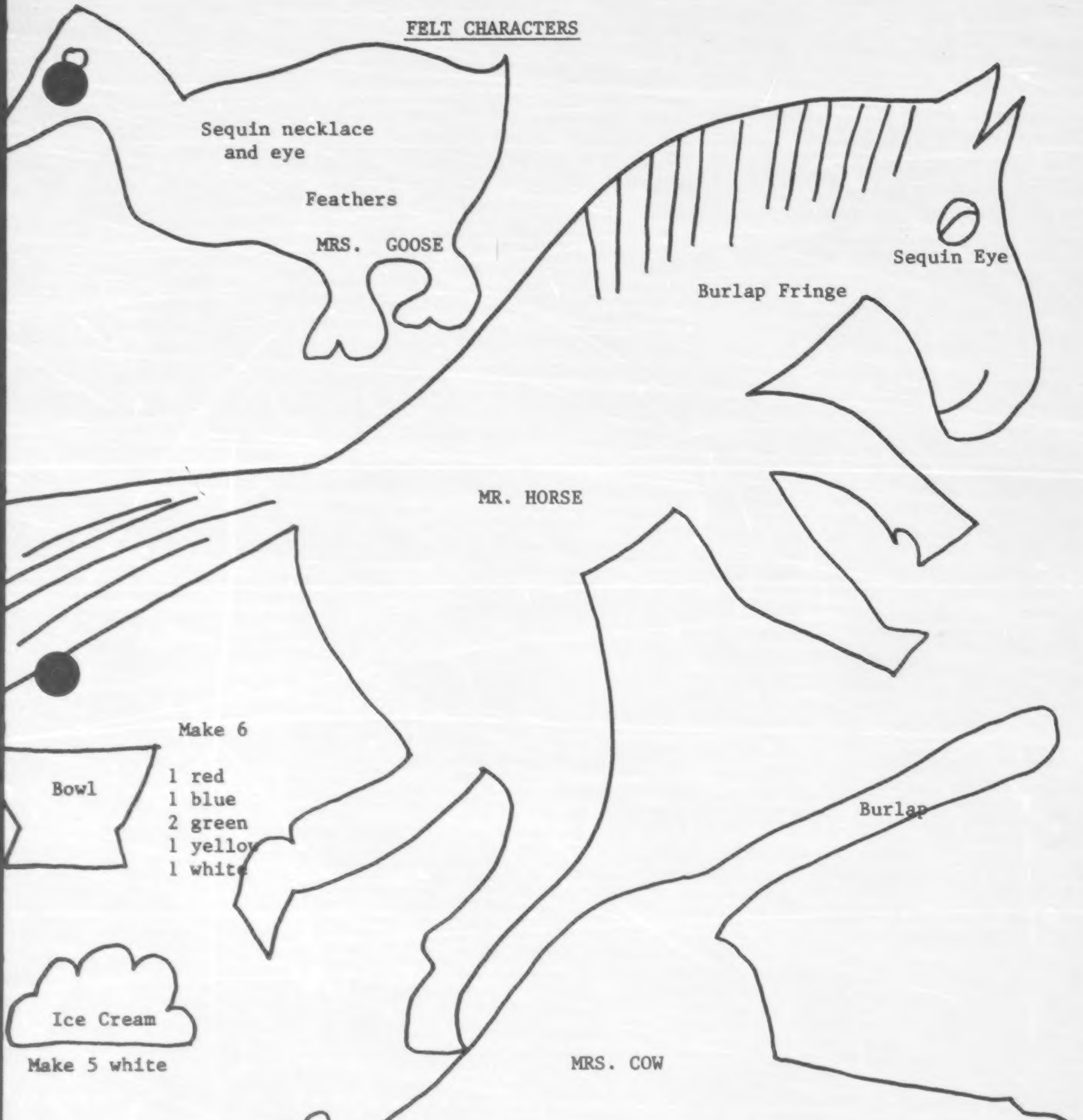
"How delicious," said the horse. "You make the very best." And
Mrs. Goose, spooning air, nodded with the rest.

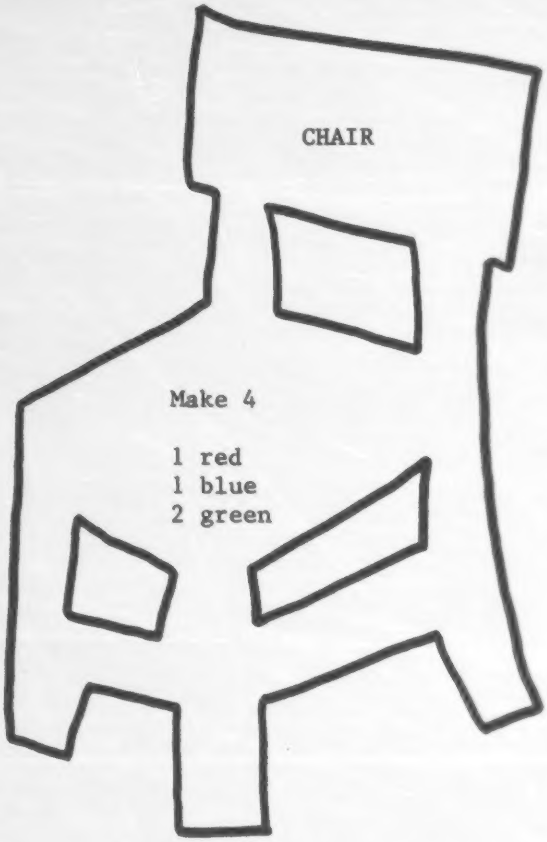
After she had served them, in her very nicest style, she gathered
up the dishes, and they sat and talked a while.

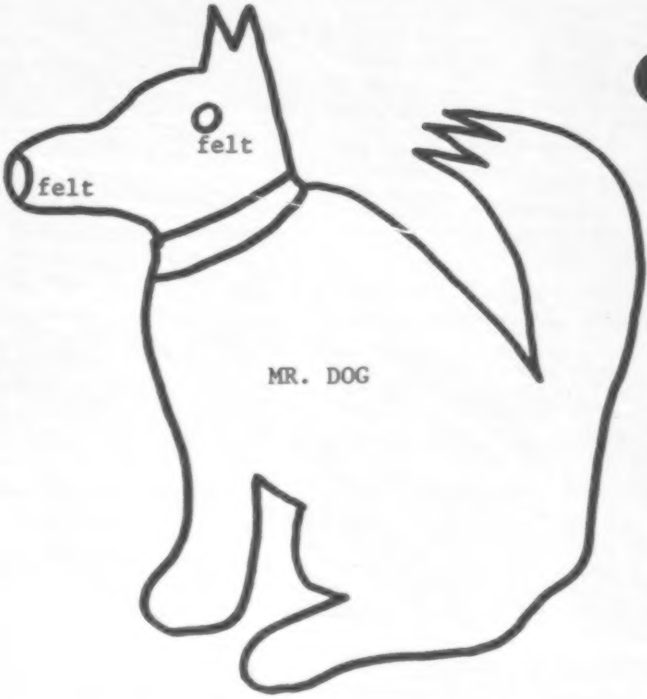
(Remove guests)

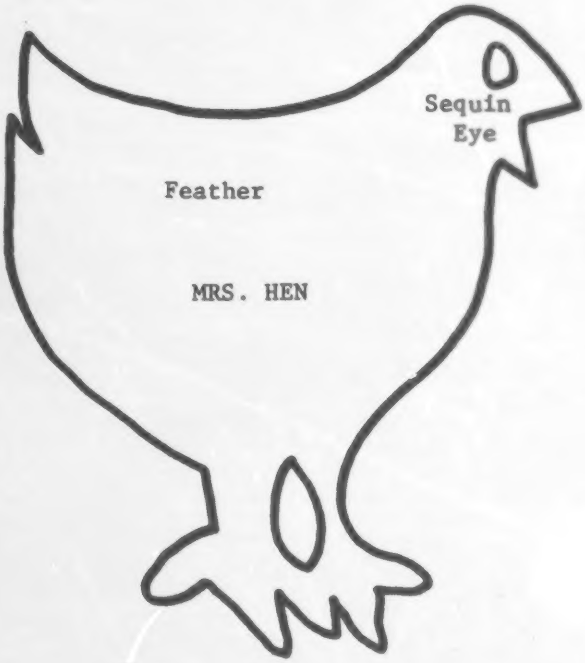
Then as they left, kind Mrs. Goose said, "Please come another day."
If you had been there in her house, you could have heard her say:
"At my own party! No ice cream! I can't have this again! Before
I have another, I must learn to count to ten!"

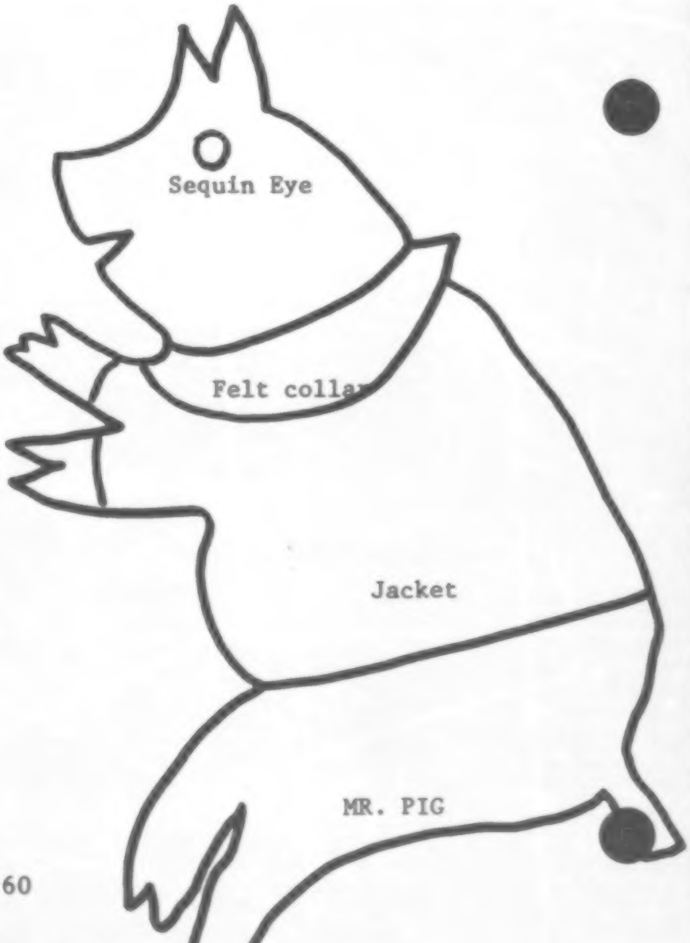
FELT CHARACTERS


Sequin necklace
and eye
Feathers
MRS. GOOSE
Sequin Eye
Burlap Fringe
MR. HORSE
Make 6
Bowl
1 red
1 blue
2 green
1 yellow
1 white
Burlap
Ice Cream
Make 5 white
MRS. COW
Felt flowers with
sequins in
center
felt eyes


CHAIR
Make 4
1 red
1 blue
2 green


felt
felt
MR. DOG


Sequin Eye
Feather
MRS. HEN


Sequin Eye
Felt collar
Jacket
MR. PIG

NON-EQUIVALENT SETS

The concept of non-equivalent sets stems from the concept of equivalent sets. Equivalent sets are sets that can be placed in a one-to-one correspondence with each other. They always have the same number of elements. Non-equivalent sets, therefore, are sets that cannot be placed in a one-to-one correspondence and do not have the same cardinal number. In order to show that some sets are non-equivalent, a matching scheme must be developed which will result in certain members of a set being left unpaired with members of another set. Terms such as "too many", "left over", "more than", "fewer", "less than", and "too few", may be used in a discussion of the results of the pairings.

THE SAME TEACHING STRATEGIES CAN BE USED FOR NON-EQUIVALENT SETS AS FOR EQUIVALENT SETS, USING TWO SETS CONTAINING A DIFFERENT NUMBER OF ELEMENTS.

CONCEPT: Comparison - One to many matching

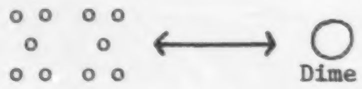
Stage of Development: Concrete

Equipment:	Coins One dollar bill Ten dollar bill

Activity:

The concept of one to many matching is important in learning the value of the various pieces of money. To demonstrate the concept of one to ten matching, the teacher should require the students to pair pennies and dimes so they have the same value.

e.g.



Similarly, pennies and a half dollar would yield 50 pennies per 1 half dollar; pennies and a dollar bill, 100 pennies per dollar bill; pennies and a ten dollar bill, 1000 pennies per ten dollar bill. The many to one matching concept is also valuable when studying place value and metric measurement.

RECOGNITION OF NUMERALS

Introduction

NUMBER VERSUS NUMERAL

Keeping in mind that the concept of number is an abstraction, let us now turn to the numerals which name these numbers. A numeral is a symbol (such as the character "5" or the word "five") for a number. The number is an idea for which the numeral stands.

It is difficult to maintain the correct use of the words "number" and "numeral". Occasions will arise when it will not be clear whether one should say number or numeral. Also, there will be times when correct usage will be awkward. A child may be asked to go to the chalkboard to write a 2, and the MIP might say, "Go to the board and write the number two." This is incorrect usage, but it would be clumsy to say, "Go to the board and write the numeral for the number two." One should not get bogged down in language. Children understand that "write the number two" refers to the symbol for the number two.

Here is a good rule for the use of the number-numeral terminology. Whenever a person is referring to the symbol itself and not to the number, he should say numeral; in all other cases, say number. Keep in mind, also, that it is better to abuse the language slightly than to make a major issue of it and confuse the children.

CONCEPT: Numeral recognition

Equipment: Fish made from construction paper (with paper clips for mouths)
Small fishing pole with a small magnet for a hook
Numerals on the sides of the fish

Activity: A circle representing a pond is drawn on the floor. The fish are placed in the pond. Three or four poles may then be used at the same time. One of the children can catch a fish by bringing the magnet into contact with the paper clip used for the fish's mouth. The child must declare how many pounds the fish weighs by reading the numeral on its side. All the children should have an opportunity to catch a fish.

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Equipment: Large number line on floor

Activity: The number line is taped to the floor. The MIP then stands beside one of the numerals and questions the children as to its identity. This is repeated for different numerals. The children may also be asked to stand on a particular numeral.

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Equipment: Hundreds board
Small disc with pin

Activity: The hundreds board is placed so all can see it. The children are told to close their eyes. One of the numbers is covered with the small disc. The children then open their eyes and tell the Mathematics Instructional Paraprofessional what numeral has been covered.

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Equipment: Hundreds board
Catchers mitt

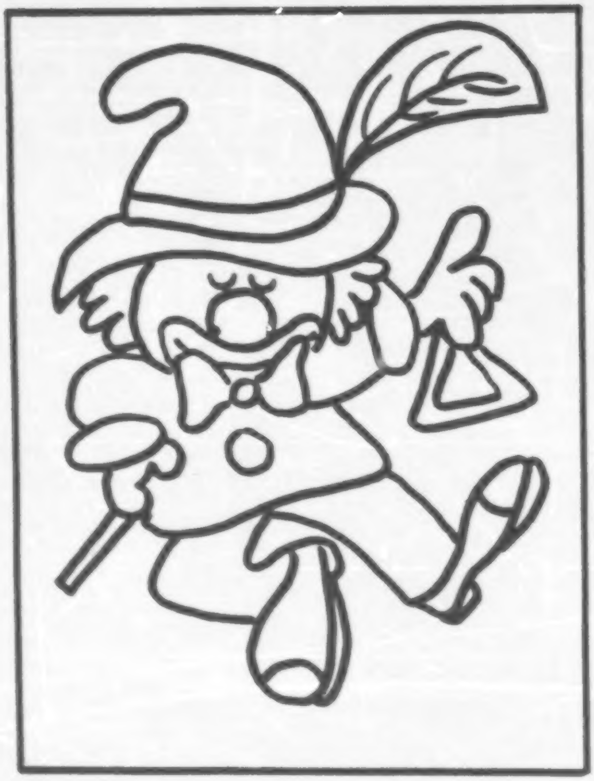
Activity: The MIP "catches" a certain number, while a child identifies it.

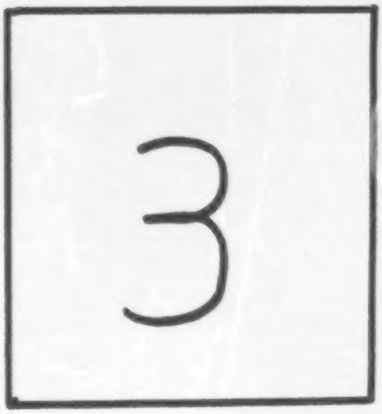
A child used the catchers mitt to "catch" a number designated by the MIP.

CONCEPT: Numeral recognition

Equipment:q Cut cards 4" x 3½". Make cards attractive for children.

Activity: Hand out cards to all the children in the class. State one of the numerals verbally. Require the child having this numeral to stand and show it to the rest of the class.



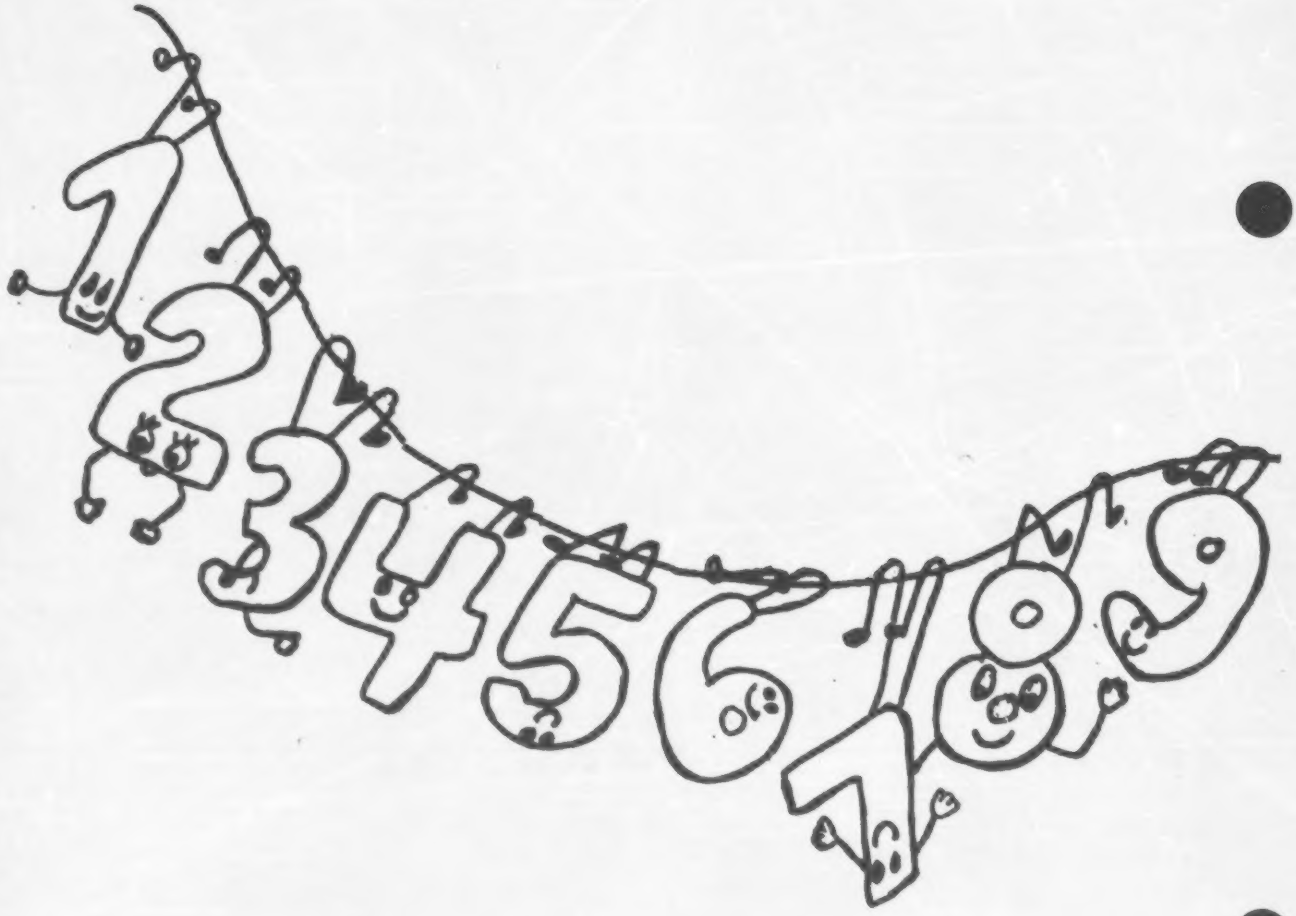


Recognizing Numerals

Use magnetic board. Put numerals in various places on board. Have objects to give child, such as: "Place the "red apple" by the number "9". This reinforces colors and you could include positional relationship. Also reinforce, using shapes.

CONCEPT: Numeral recognition

Equipment:	Numerals cut from tagboard about 5" tall.
Activity:	Each student has his own set of numerals. Mathematics Instructional Paraprofessional verbally calls out a numeral and each child holds up that numeral. Repeat activity. These numerals also can have pipe cleaners attached and hung over a line. Numerals can also be used for order, missing numerals, before, after and between.



NUMBER WORDS

Introduction

If a child can recognize and use the number words one, two, three, four, five, six, seven, eight, nine, ten, twenty, thirty, forty, fifty, sixty, seventy, eighty, ninety, and one hundred, he should be able to read any number word from one to nine hundred ninety-nine. Being able to read number words, and to write the numeral that represents the number word, is essential in the writing of checks. This section will concentrate on number word recognition and on the numeral associated with the number word.

CLASSROOM ACTIVITIES

CONCEPT: Number words

Equipment:	Miscellaneous objects Box Number word cards
Activity:	The objects are shown to the students. They are told that the MIP is going to place several of the objects in the box, and that they are then going to be asked to tell how many objects are in the box. The objects should be transferred, one at a time, from the desk to the box, making certain that each object is visible only as it is transferred. The students count the objects as they are placed in the box. One child may then show the teacher the number word that describes the set.

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Equipment:	Chalkboards Number word cards
Activity:	Hold up a number word card for all to see. Require the children to write the numeral representing this number word on their chalkboards.

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Equipment:	Magnetic board Magnetic cards showing number words Show-Me Boards (cards showing numerals)
Activity:	A number word is placed on the magnetic board (e.g., nine). Someone is asked to read it and to show the numeral that it represents, using "show-me board".

80

CONCEPT: Number words

Equipment: Cards showing number words and numerals representing the same numbers.

Activity #1: Hand out the number word cards to all the children in the class. Hold up a numeral for all to see. Ask the child having the number word card representing this numeral to stand and show his card to the rest of the class.

Activity #2: Reverse the procedure of the above activity. Hand out numeral cards to the children. You hold up a number word card.

CONCEPT: Number word recognition

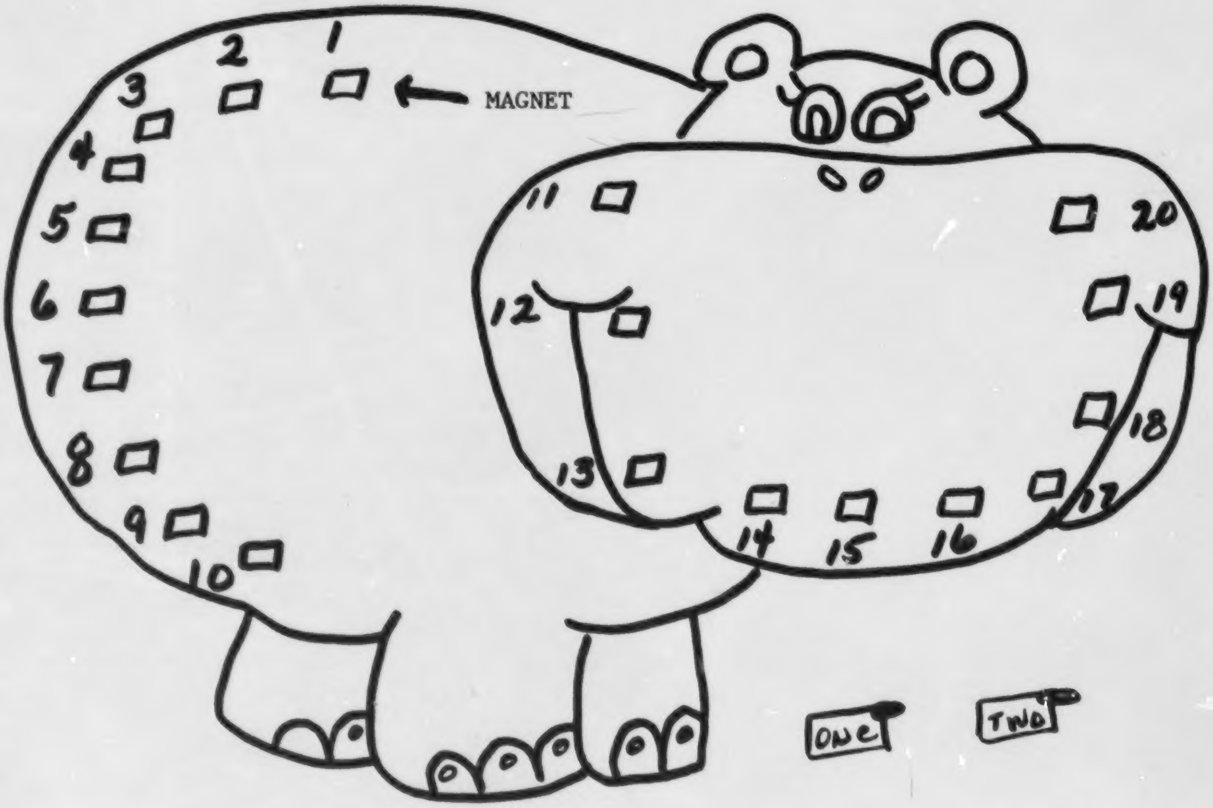
Equipment:

1 - 8" x 12" piece of tagboard
20 pieces 3" x 2" tagboard
20 magnets
20 paper clips

Around the figure (hippo) 8" x 12", write the numerals 1 - 20. On the right side, glue on a magnet across from each numeral. On the small 3" x 2" tagboard, write the number words. Attach a paper clip to each of these.

Activity:

Mix the number words up. Have child draw and then put on board beside the correct numbers. If they miss, they keep it. The object is not to have any cards at the end of the activity.



CONCEPT: Number word recognition

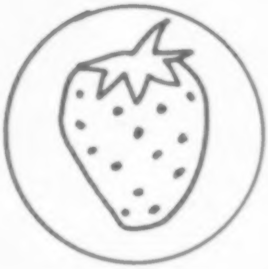
Equipment:

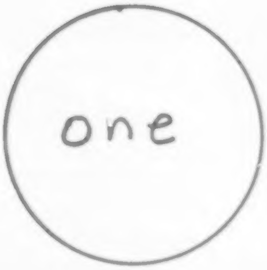
40 circles - 2" x 2"
Gummed stickers

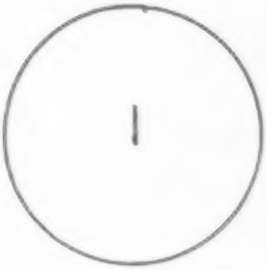
Write number word on back of 20 circles. Write numbers on back of other 20 circles.

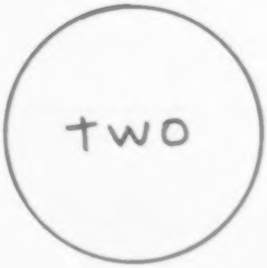
Activity:

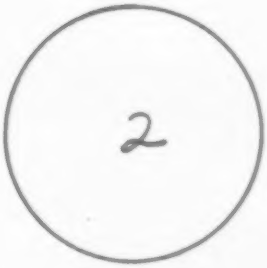
Turn all circles numeral side down. First player turns over two circles and tries to match number word with correct numeral. If matched correctly, they keep the circles. Player with the most circles comes in for first place.









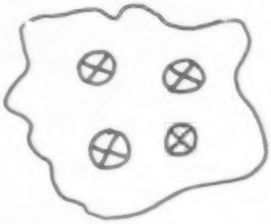


FORMING SETS FOR NUMERALS

Introduction

To aid in the child's understanding of the cardinal number of a set and the numeral associated with this number, the experience of forming sets having these numerals is of importance. Rational counting will also be strengthened with this activity.

The forming of sets enables the MIP to see if the child understands the meaning of a "4", which means a set of four elements.

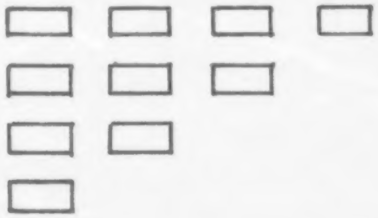


CLASSROOM ACTIVITIES

CONCEPT: Forming sets

Equipment: Large number line on floor
Counting objects (blocks, etc.)

Activity: The number line is taped to the floor. Each child is given a set of objects. He must form a set of objects to the right of a numeral on the number line. The set must be equal to that numeral. This is continued until all the numbers have had sets made for them. This is an opportunity time to discuss the concept of "one more than". This is an obvious concept when one compares the sets vertically.



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Equipment: Geo board
Numeral cards
Rubber band

Activity: Each child receives a geo board and a rubber band. He is either shown a numeral card or is given a numeral, verbally. The child then encloses a set of nails on his geo board, equal to the numeral given to him. The cardinal number of this set of nails should be the same as the numeral shown to the class.

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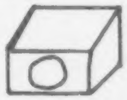
Equipment: A box which has a hole large enough for a child to place his hand inside the box
cards showing cubes, numerals,  ,
or sets.

Activity: Several blocks are placed inside the box. The children are given instructions to reach inside the box and pull out a certain number of blocks. (E.g., "Please get me four blocks from the box.") The number must be kept rather small, because the children's hands are small.

Equipment:
Individual flannel boards
Flannel objects

Activity: The MIP verbalizes the cardinal number of a set. The children all have a flannel board and objects. They must form, on their flannel boards, a set which has the cardinal number stated by the MIP.

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Equipment:
Individual flannel boards
Flannel objects
Cards showing sets

Activity: The MIP holds up a card showing a set and the children form an equivalent set on their flannel boards.

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CONCEPT: Forming sets for numerals

Equipment:
Overhead projector
Pennies or flannel objects with which to form images
Flannel numerals

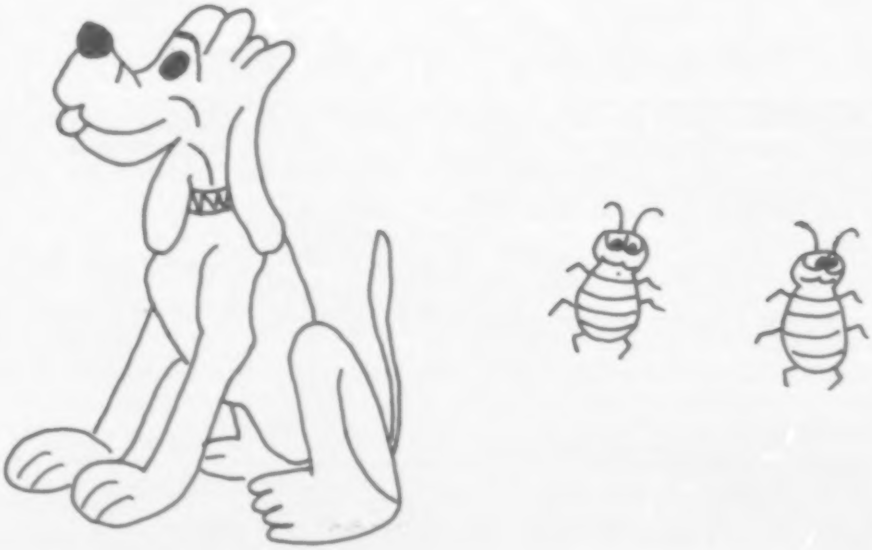
Activity: A numeral is placed on the overhead projector and the students are asked to name it. Someone may then construct a set, representing the numeral, on the overhead projector. As the set develops, the number of each object must be said as it is placed on the overhead projector. When the correct amount is reached, the class should stop counting.

OFF MY BACK

Materials:	Game board Fleas Cards Number Cube

Preparation: Draw a large dog on a large piece of pellon or poster board. Make 1" x 1" squares of pellon (about 50). In each square draw a flea with a black felt tip pen. On more than 1/2 of the fleas, draw another flea on the back of the square. The rest of the fleas are blank on the other side. Prepare a deck of cards for the desired concept.

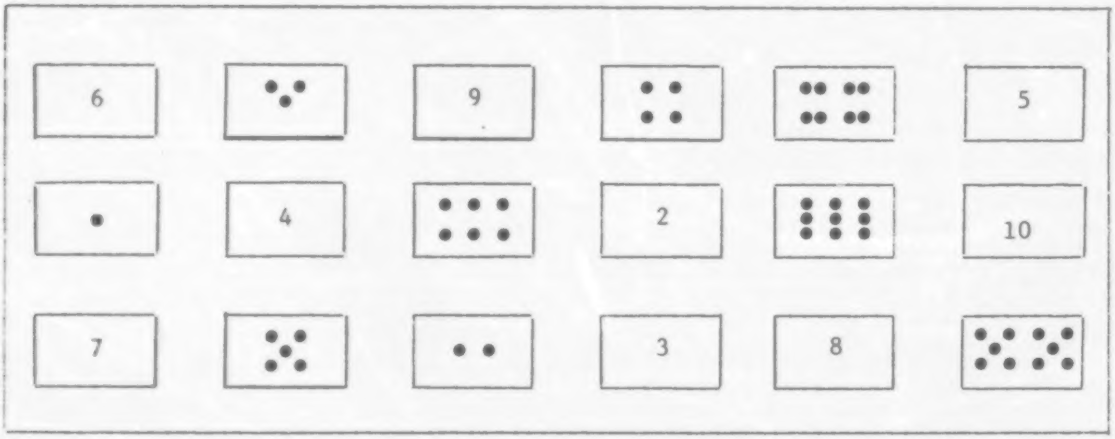
Procedure: This game can be used for many concepts; recognition of sets and numerals, even and odd numerals, joining sets, addition facts, subtraction facts, etc. The fleas are placed on the dog with no blank sides showing. The player rolls the number cube, then he takes a card. If he solves the problem on the card correctly, he may turn over the same number of fleas on the dog as is shown on the number cube. The fleas he turns over that are blank on one side remain on the dog. Those fleas that the player turns over that are doubled may be taken off the dog by the player. All fleas turned over must be counted. The player with the most doubled fleas is the first winner.



POCKET MATH

Materials:
1 - 24" x 36" piece of tagboard
18 - library pockets
1 - deck of 3" x 4" construction paper cards

Procedure: Fold the tagboard lengthwise and paste it down. This will make a 24" x 18" double thick piece of tagboard. Fold this piece of tagboard into three sections. Paste six library pockets in each section (see illustration below).



Use a paper clip to hold either set cards or numeral cards to the library pockets. This will allow you to change the labels of the pockets easily.

Instructions:

1. Give the student a deck of cards that corresponds to the numerals or sets found on the library pockets.

2. For kindergarten, merely ask the children to match the card to the pocket (numeral to numeral and set to set). First grade children may be asked to match numeral to set and set to numeral.

CAGE THE BEAR

Materials: 1-20 berry baskets
Teddy bear counters

Procedure: Turn baskets upside down, tape number cards with numbers 1-20 on top of basket.

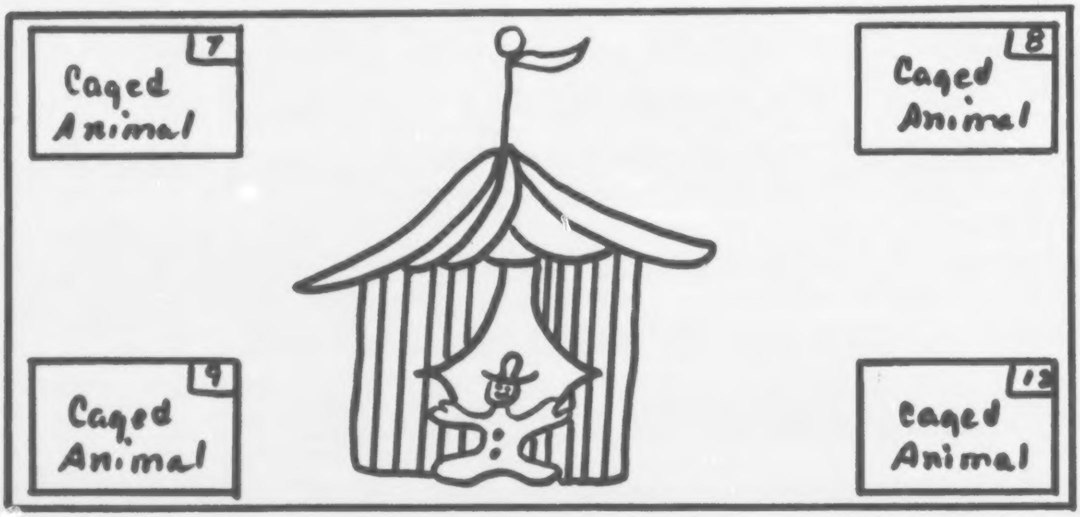
Instructions: Children cage as many bears as indicated by number on each basket.

CIRCUS CAGES

Materials: 22" x 28" cardboard
4-8 library pockets for cages
Deck of problem cards
Deck of answer cards

Procedure: Draw a circus tent in the center of board. Attach library pockets around the tent. Attach an answer card to each "cage."

Instructions: Each pupil draws a card from the problem cards. He then places the card in the correct answer cage (i.e. all problems whose answers are 7 in the 7 cage, etc. or the numeral 5 in the cage, etc.) If more than one student plays, a tally sheet for each correct placement should be kept. The student with the most tallies is the winner.



MATCHING NUMERAL WITH SET

Introduction

As soon as pupils can readily recognize and name the number of a group, they can be shown the numeral (e.g., 3) that tells how many objects are in the group.

In the previous section, the student was required to form sets for given numerals. This section emphasizes this understanding in reverse (i.e. Matching numeral with set).

CONCEPT: Matching numeral with set

Equipment: Individual decks of cards showing numerals
6" cubes whose sides show sets

Activity: The MIP rolls a cube, exposing the set on its top side. Each child has a deck of cards showing numerals. Each one is expected to choose the numeral representing the cardinal number of the set exposed and then to show it to the MIP.

This is repeated by throwing the cube several times.

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Equipment: Individual decks of cards showing numerals
Counting objects

Activity: Each child is given a deck of numeral cards. A set of objects is placed on a table so all can see it. The children then select from their decks the card that shows the numeral which represents the set. The cards are held up for the MIP's inspection.

****

Equipment: Flannel board
Flannel shapes
Numerals

Activity: A set of flannel shapes is placed on the flannel board. One student determines the number of elements in the set. Someone else selects the numeral and places it on the flannel board next to the set that it represents. The sets are changed and the activity continued until all have had an opportunity to participate.

****

Equipment: Flannel board
Flannel objects
Numerals
Pieces of yarn

Activity: Different sets are formed on one side of the flannel board and numerals are placed on the other side. The children match the numerals and sets by connecting them with pieces of yarn.

CONCEPT: Matching numeral with set

Equipment:
Overhead projector
Flannel numerals
Objects to be used on the projector

Activity: A set is formed on the overhead projector. A child selects the correct numeral for this set and places it on the projector for all the class to see. This activity is repeated with many sets.

****

Equipment:
Overhead projector
Pen

Activity: Several sets, containing different numbers of elements, are drawn on the overhead projector. The cardinal numbers of the sets are written below or to the side. Children then come to the overhead projector and draw lines connecting the numerals with the sets that they represent.

****

FISHING DERBY

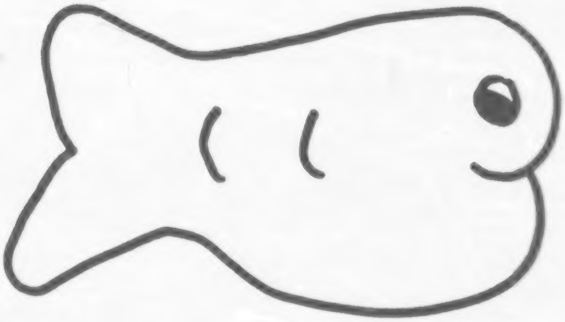
Materials:
1 - 36" piece of dowel road
Box of paper clips
Construction paper
36" piece of heavy string
Small magnet

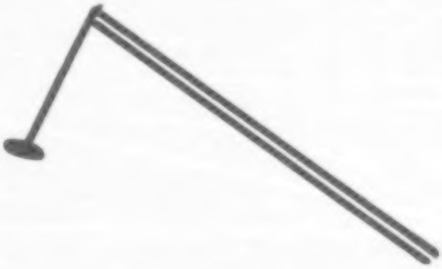
Procedure: Tie the string to one end of the dowel rod to make a fishing pole. Tie or glue the small magnet to the end of the string to serve as the hook for the fishing pole. Cut out several fish shapes from the pieces of construction paper. Place paper clips on the head of the fish to represent their mouths. Mark problems on one side of the fish.

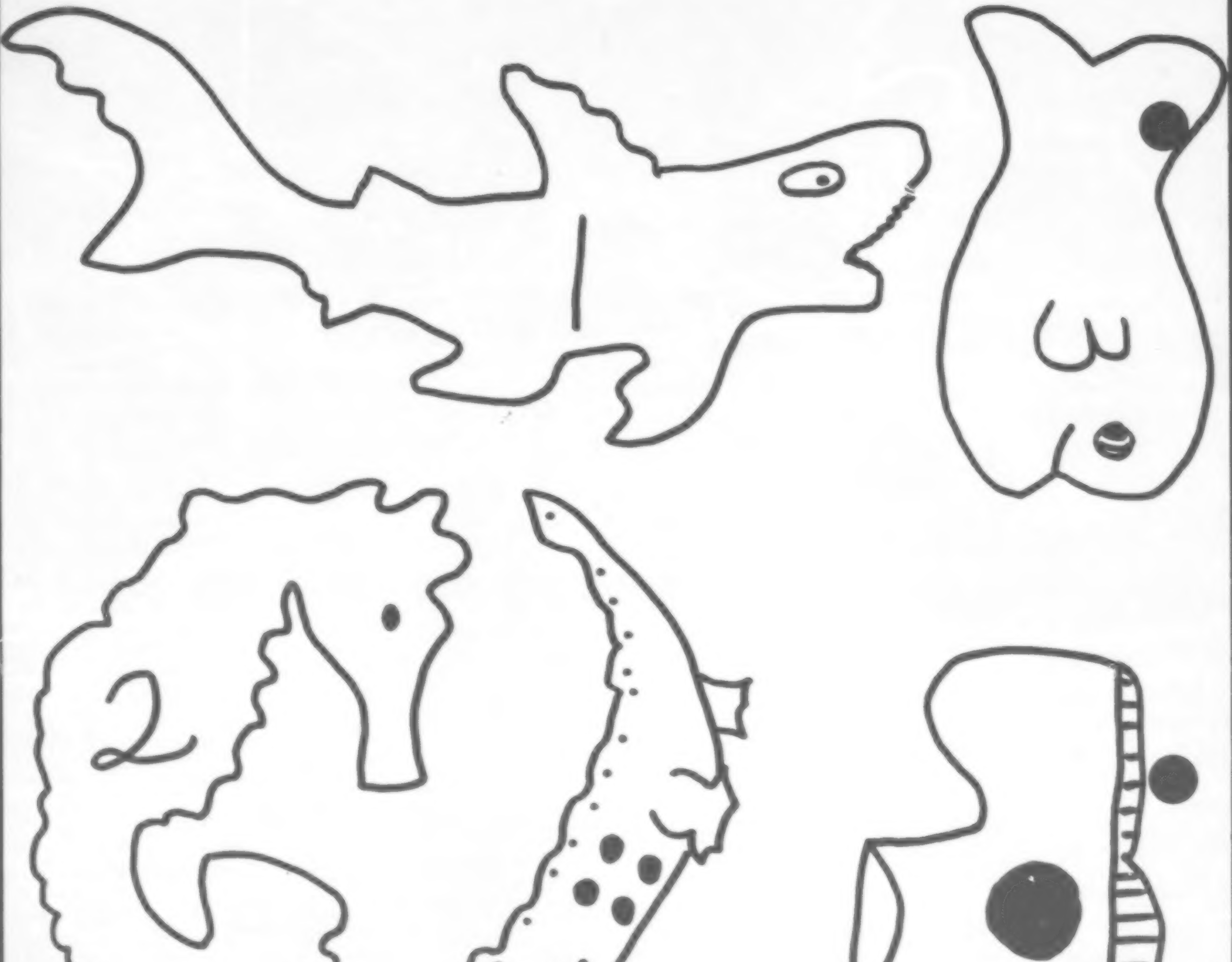
Instructions:

1. Draw a large circle on the floor to serve as a pond.
2. Using the pole, with the magnet acting as a hook, the children are required to catch a fish by bringing the magnet into contact with the paper clip.
3. The child must be able to answer the problem on the other side of the fish before he can keep the fish.
4. The object of the game is to see who can catch and keep the most fish.

*You may add variety by adding turtles, starfish, seahorses and an old boot. (These could be harder problems and worth more points). Wrong answers are dead fish and thrown back into the pond.



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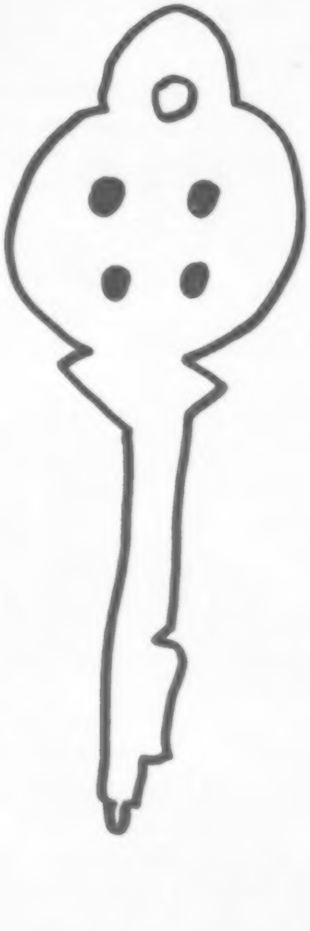
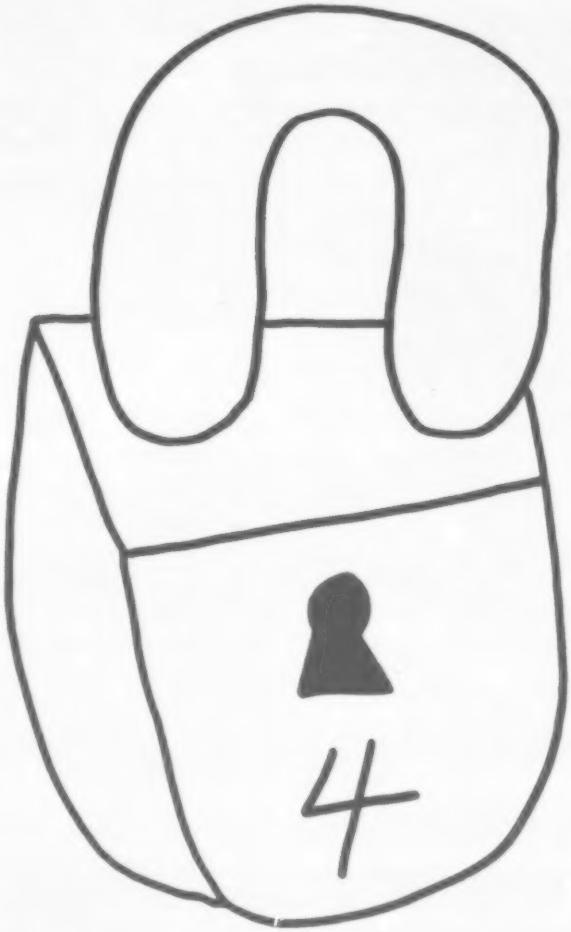
LOCKS AND KEYS

Materials:	Ten locks Ten keys Cardstock Magic markers Gummed circles Glue
Procedure:	Color in the locks and keys. Place gummed circles in set configuration on the locks; write numerals on keys. Glue onto cardstock.
Instructions:	Students are given keys and they must match them to correct locks.



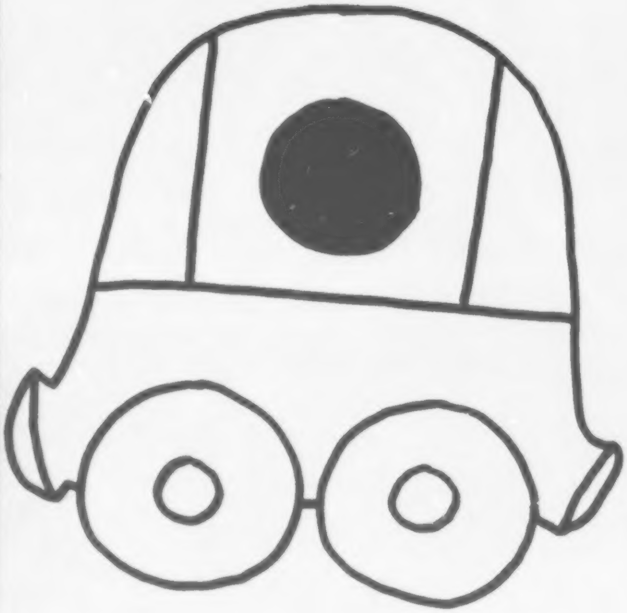


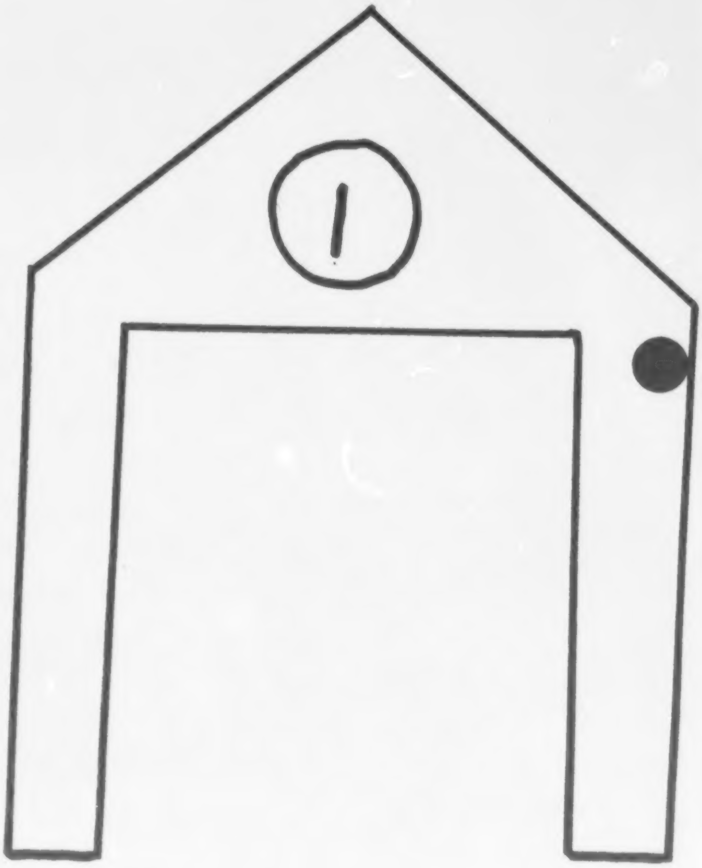
CARS AND GARAGES

Materials:
Ten cars
Ten garages
Gummed white circles
Tagboard 14" x 22"

Procedure: Color cars and garages. Put gummed white circles in set configurations on cars; write numerals on garages. Glue garages on large tagboard.

Instructions: Children are given a set of cars and garages and they must match the cars to correct garage.





WRITING OF NUMERALS

It is wise to defer the writing of numerals for some time - even until the latter part of the grade one, in some cases. Writing numerals calls for a level of physical maturation and coordination that many pupils do not have in kindergarten or the early part of grade one. Also, students must be able to recognize the numerals and their meanings before learning how to write them. Much practice in recognizing numerals and the number of objects in a given set is most desirable.

A first grade child should be able to write the numerals 0-9, and also understand the concept of place value, before he attempts to write numerals greater than nine.

CONCEPT: Writing numerals

Equipment: Instant pudding
Finger painting paper

Activity: Use instant pudding mixture as finger paint material. Each child practices his numerals in his pudding.

****

Equipment: Sandpaper
Textured wallpaper
Numerals 0-9

Activity: The child traces the sandpaper or textured wallpaper numeral with his finger in order to determine its form.

An alternate activity would be to have the child close his eyes and trace a numeral, then guess the identity of the numeral.

CONCEPT: Writing numerals

Equipment: Overhead projector
Pen

Activity: The children are to write numerals on the overhead projector when the MIP gives them a verbal description of the numeral. (E.g., "Make a six.")

****

Equipment: Individual chalkboards

Activity #1: The students will write a numeral given verbally by the MIP. Several numerals should be given.

Activity #2: The students write the numerals from 1 to 10 on their chalkboards. As the child matures in his ability to write numerals, the number of numerals can be increased.

Activity #3: One child begins counting with some particular number. The MIP stops him, and the class is then asked to write the numeral on which he was stopped.

****

Equipment: Individual chalkboards
Domino flash cards

Activity: A flash card with a domino pattern is shown to the class. Each student is to write on his chalkboard the numeral that represents this pattern. He then holds it up for the MIP's observation. Several different domino patterns should be used.

DOUGH ART NUMBERS

Materials:
- flour (2 cups)
- salt (1 cup)
- mixing bowl
- mixing spoon

Instructions:

1. Mix 1 cup of salt, 2 cups of flour, and 1 cup of water together. Knead 7-10 minutes until dough is smooth and putty like.

2. Give each child a portion to make a number series 1-10 or whatever numbers they need practice writing. (This will help reversals.) Have the child make "snake" shapes and form into numbers.

3. Bake on a cookie sheet at 325 degrees until light brown (or let air dry 48 hours on a window scrren).

4. When cool, they be varnished to protect from moisture, or painted any color. This is a permanent reminder for those children who make numbers backwards.

To color dough:

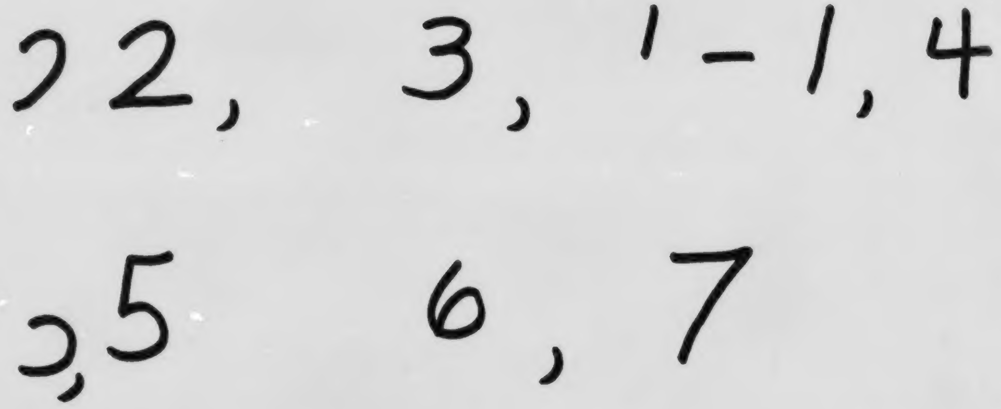
1. Add food color to water before mixing.

2. Or--add food color to dough after it is mixed. Put it in a plastic bag and squeeze the bag until color is mixed into dough.

NUMBER RHYME

Materials: Number Rhyme Story
4 magic slates

Instructions: The MIP will read the rhyme and each child will mark on his slate as he is told what line to make, to form each numeral.



NUMBER RHYME

One is like a soldier tall.
Just a line and that is all.
Write him straight down from the top
To the bottom---line and stop.

Make a curve like an ear,
And then follow through
With a straight line to rest on
And you have a Two.

A ruffle on his jacket,
All dressed up for tea.
Around and 'round the ruffle
I make a Mr. Three.

The Four gate in the garden
Takes three lines I have found
One half way down, one over,
One straight down to the ground.

Straight down and around
A duck alive
Add a bill
To make a five.

Curving down around and in,
A monkeys tail I see.
That is how I make a six.
As easy as can be.

Straight over----slant down
A Seven is easy.
Like a waving flag
When it is breezy.

Around and down and up you go,
Like a snowman in the snow.
Standing round and fat and straight,
There you have a Mr. Eight.

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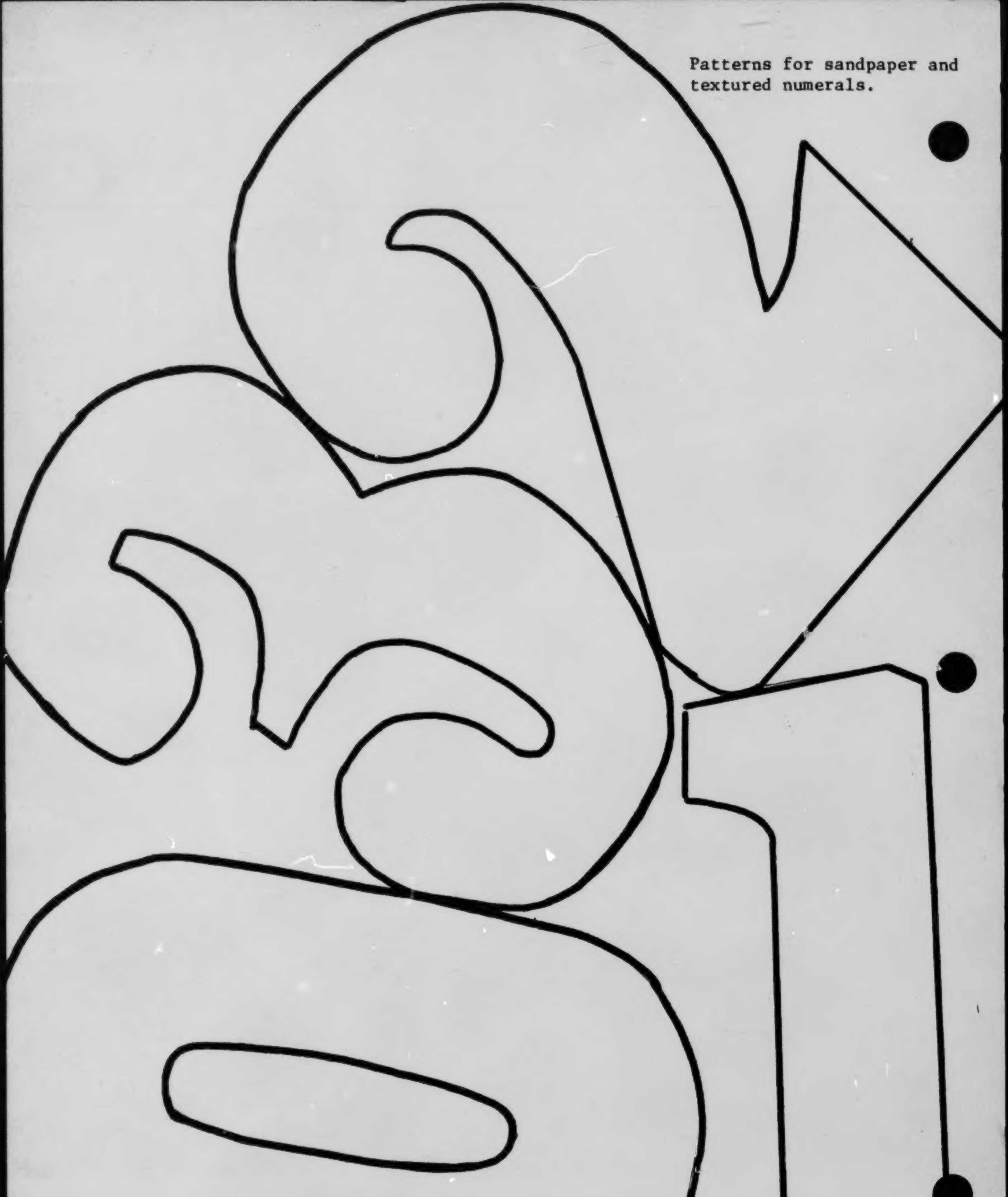
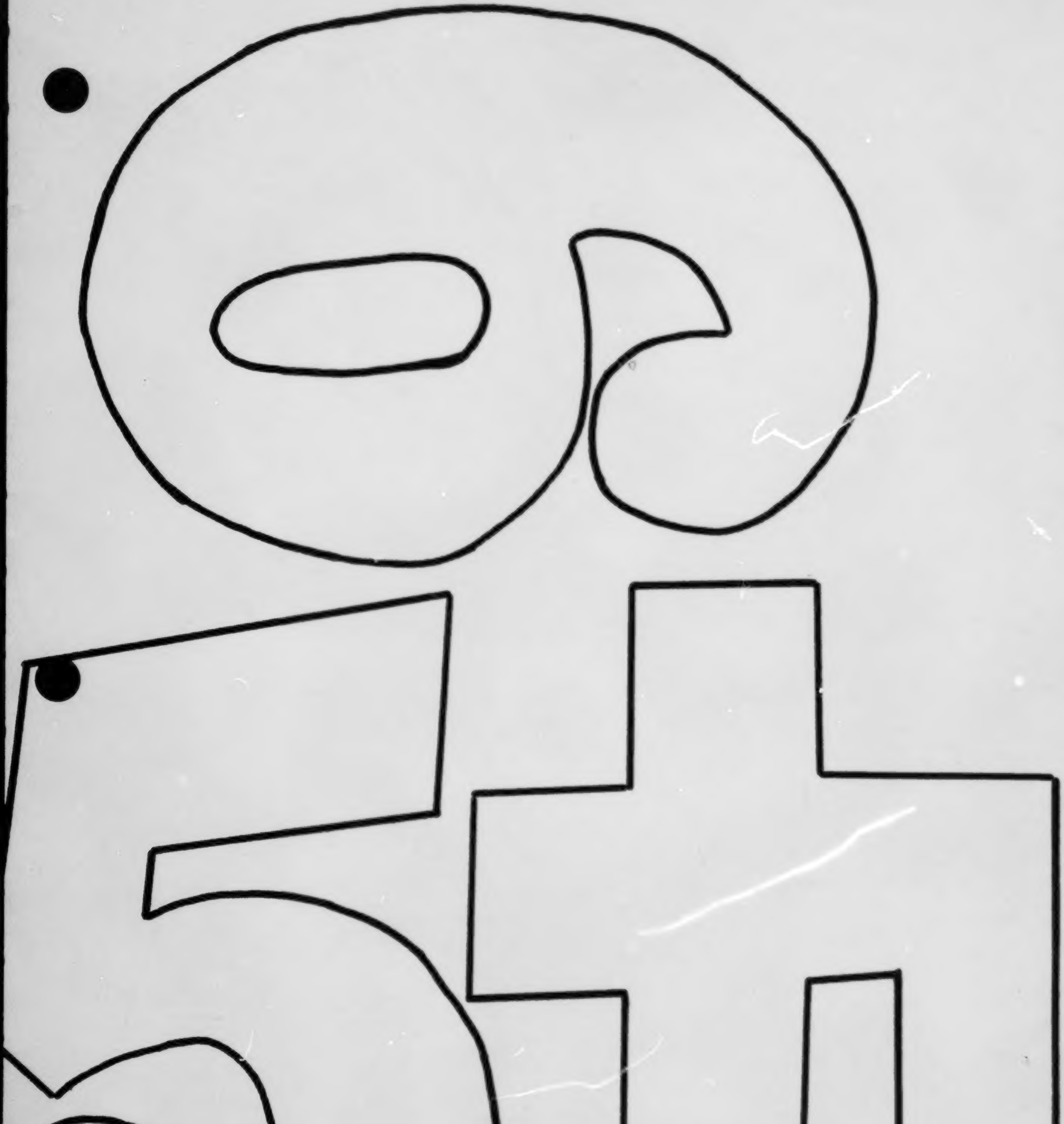
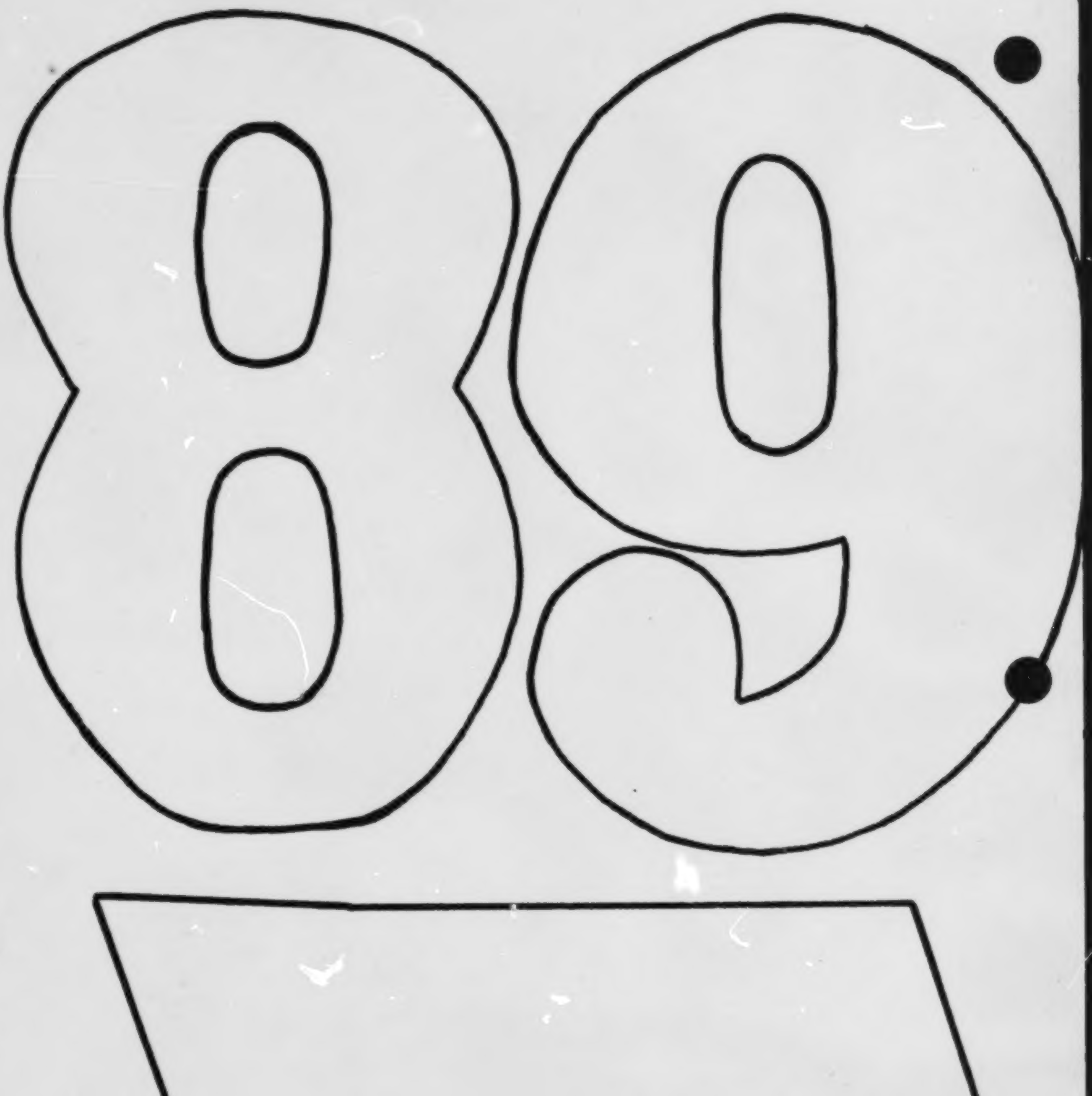
Close the circle and draw a line,
And there you have a Mr. Nine.
A round balloon upon a stick--
A very simple circus trick.

Zeros are eggs
Without the legs.
One a a zero make Ten.
Soldier tall
And Humpty ball.
A Humpty-dumpty Ten.

Patterns for sandpaper and textured numerals.



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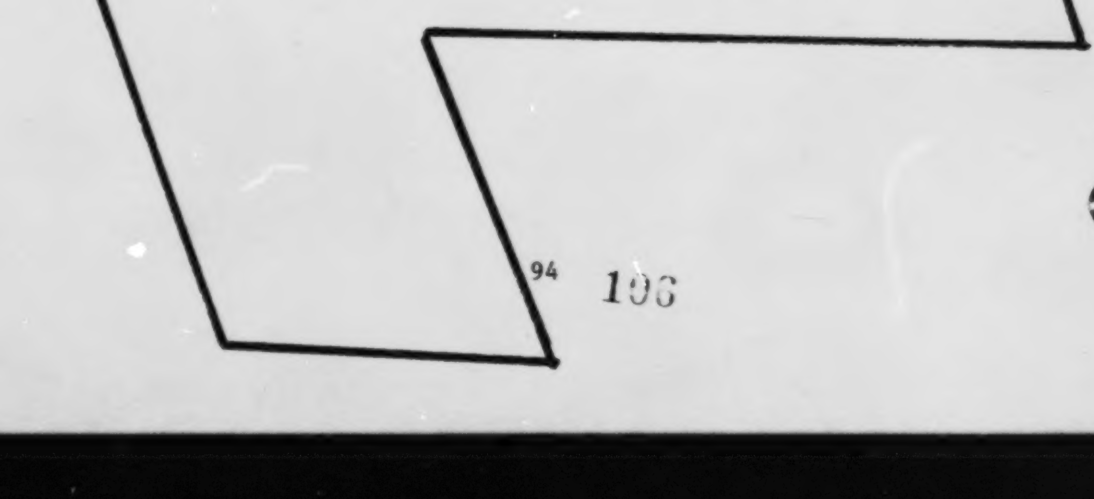
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ORDER OF NUMERALS

Introduction

The order of the whole numbers used in counting emerges naturally from work with sets. Beginning with the empty set, one member at a time is added (or joined). The cardinal numbers of the respective sets formed are a natural sequence of the whole numbers, each number being one greater than that in the previous set. Therefore, it is important to work with ordering sets before talking about the ordering of numerals.

The set of whole numbers is said to be order. This means that every non-empty subset of the whole numbers has a smallest element. For example, in the subset /2, 3, 4/ there is one element, two, which is less than any other element in the set. This property of ordering enables one to find the whole number between, before, and after a given whole number. This also means that with any two whole numbers one can tell which is less and which is greater.

A good understanding of the concepts of order will be essential before the child can understand the concept of a number line.

CONCEPT: Order of numeral

Equipment: Children

Activity: Several children are arranged in a row. The MIP asks questions about the children who are in a certain position in the row. These questions should be concerned with the concepts of "between", "in front of", "coming before", "coming after", etc.

****

Equipment: Paper cups that are numbered (1 - 10)

Activity: The cups are given to one student with these instructions: "Arrange the cups so the numerals will be in their correct order." This can be repeated with several children.

****

Equipment: Magnetic board
Cards showing numerals (with small magnets glued to the backs)

Activity: The cards are given to a child with the instructions that he must arrange them on the magnetic board in their proper order. If he does it incorrectly, someone else may help him do it correctly. When the child has finished, the cards are taken down from the magnetic board and another child is given an opportunity to arrange them in order. A discussion of the phrases "between", "one more than", "before", "after", and "one less than", can be used as the numerals are placed on the magnetic board.

****

Equipment: Walk on Numberline 0-10 or 0-20

Activity: The children are asked to stand or sit on a certain number and then to move forward or backward from this number. Several children should have a chance to participate.

CONCEPT: Order of numerals

Equipment:

Two chairs
String
Clothespins
Various pieces of clothing cut out of construction paper (each one with a numeral written on it)

Activity:

The student must put the clothes on the line so the numerals will be in the correct order, counting from left to right. This should be repeated with several children.

****

Equipment:

Individual chalkboards

Activity:

Children are required to write in proper sequence a set of numerals. These numerals may be one, two, three or four digit numbers.

****

Equipment:

Show-Me-Boards

Activity:

MIP writes a specific numeral on the chalkboard. The children are required to form a certain numeral on their show-me-boards as directed by the MIP (e.g., MIP writes 360 on chalkboard. Child must show the numeral that is "one less than", or "one more than", etc.)

****

Equipment::

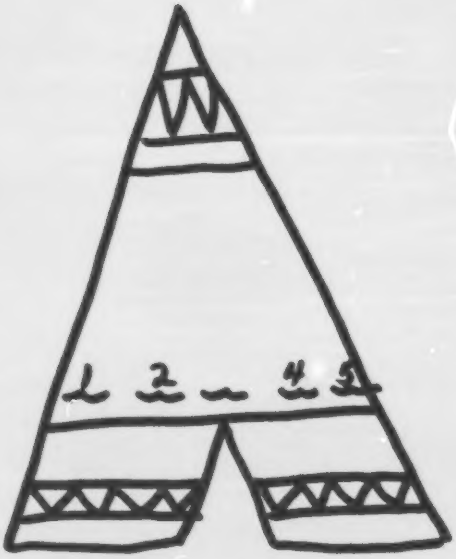
Hundreds board
Catchers mitt

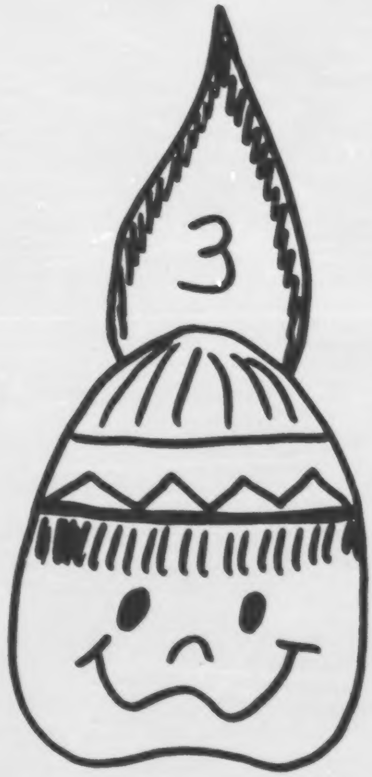
Activity:

Children are asked to catch certain numerals on the hundreds board as directed by the MIP (e.g., MIP asks child to catch the numeral that is two less than 34.)

BEFORE, BETWEEN AND AFTER

Materials:	Teepees and Indians 1-20
Procedure:	The numerals for "Before, Between and After" 1-20 should be on the Teepees. The Indian boy will have the missing numerals on his feather.
Instructions:	Each child will have his set of Teepees and Indians. He will match his Indian boy with correct teepee.





CLOTHESLINE

Materials:	5 colors of construction paper (red, yellow, blue, green, orange) Magic marker (black) 50 clothespins clothesline (twine or wire)

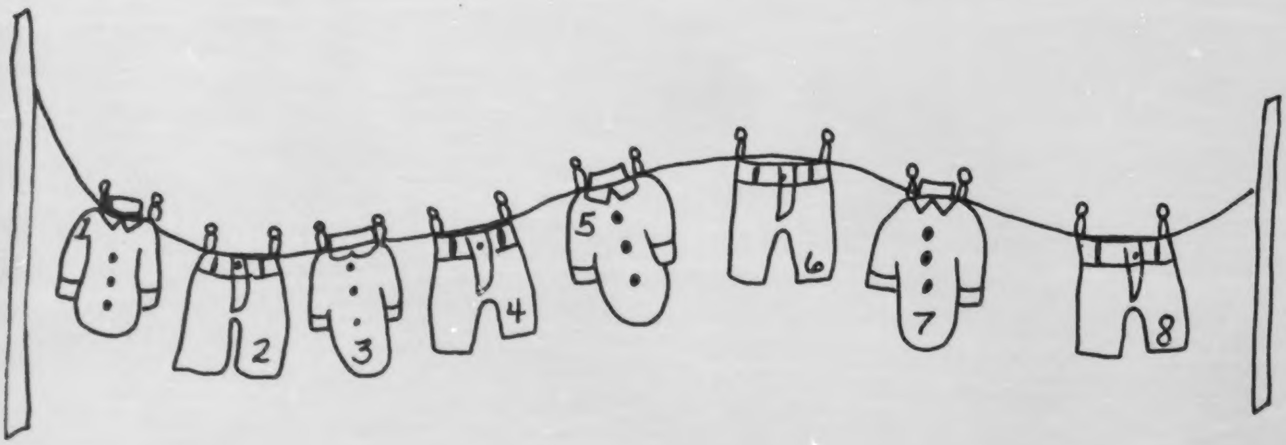
Make clothes to 100 and put 51 behind 1 and so on. Use the 5 colors in order: 1 - red; 2 - yellow; 3 - blue; 4 - orange; 5 - green; 6 - red; 7 - yellow, and so on.

Rational counting: Count all the shirts and pants

*Numeral recognition - 100: Numerals are on all

Counting by 2's:	Count all the pants (shirts are odd; pants, even)
Counting by 5's:	Count all the green shirts and pants
Counting by 10's:	Count all green pants
Order of numerals:	Take down random clothes - leaving clothespins - and have students put them back in the right order.

*Note: Students love to make outfits from the correct answers (can be used for all concepts listed). When time runs out, count to see who has the most. They also like to help you put them back on the line.



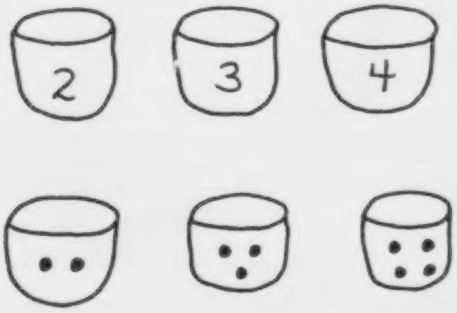
BUTTER TUB MATCH

Materials: 11 butter tubs
Pegboard pegs or counting cubes
Small pieces of various colored construction paper

Procedure: Glue construction paper to the bottom inside the butter tubs. Use the same colors as the pegs or counting cubes. Mark one side of the tub with a numeral 0-10 and the other side with a corresponding set.

Instructions:

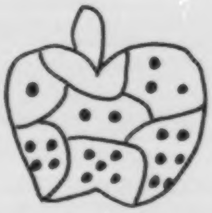
1. Give the child all the butter tubs.
2. Require the child to arrange the butter tubs in their proper numerical sequence.
3. The child then must place the correct color and number of pegs or cubes into the tubs as designated by the color of the construction paper and the numeral on the side of the tub.
4. Check to see if the child has arranged the tubs in correct order and that they contain the correct number of objects.

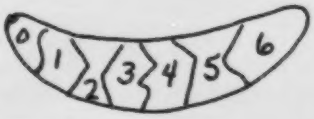


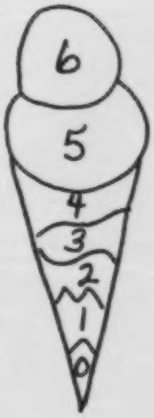
PUZZLES - ORDER

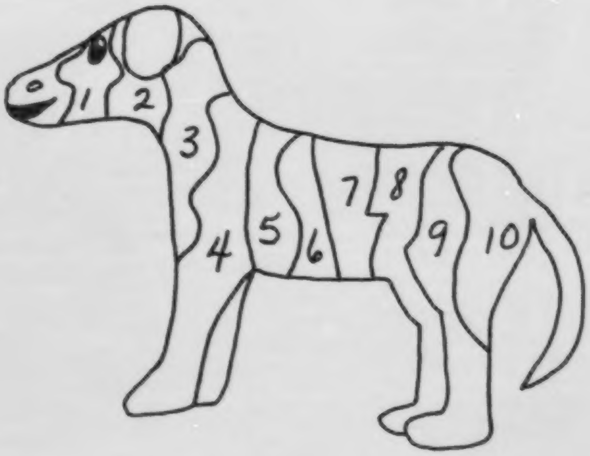
Materials:	Tagboard or poster board Magic markers
Procedure:	Cut some shape out of the tagboard, color it and put numerals or sets from 0-6 or 0-10 on the shape. Cut out each numeral or set so that each is on one piece.
Instructions:	The child must put the puzzle together according to the order of sets or numerals.

Examples:









NUMBER COMPARISONS

Introduction

The set of whole numbers is said to be ordered. This means that every nonempty subset of whole numbers has a smallest element, a largest element and the others can be arranged in a sequence relative to their value. This property of ordering enables one to find the whole number between, before and after a given whole number. This also means we can compare any two different whole numbers to determine which one is less and which is greater than the other.

EVEN OR ODD NUMBERS

When children count the objects in a set, they can arrange the objects in groups of twos, so that it becomes obvious that the groupings result in either one object left over or no objects left over. If there is one object left over, there is an odd number of objects in the set. If none are left over, the set contains an even number of objects.

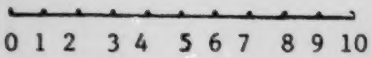
PRIME NUMBERS

There is one set of whole numbers that are only divisible by themselves and one. These numbers are called prime numbers.

CONCEPT: Number comparisons

Equipment: Large number line on floor

Activity: The number line is taped to the floor. Then, the children are asked to stand on certain numerals. (e.g., "Stand on the numeral six.") As the MIP describes numerals on which the children are to stand, he uses these terms: "one more than"; or "between".



1. "Stand on the numeral that is one less than five."
2. "Stand on the numeral that is between five and seven."
3. "Stand on the numeral that is one more than three."

****

Equipment: Large, stand up styrofoam numerals

Activity #1: The order of the numerals is mixed. A student comes forward and rearranges the numerals so they are in the correct order. The children then turn their backs and the MIP again mixes the numerals. Another student fixes the order so it is again correct. This should be repeated several times.

Activity #2: The numerals are arranged in correct order. The teacher questions the children about numerals that are in a certain position.

1. "Show me the numeral that comes before the numeral six."
2. "Show me the numeral that is between four and six."
3. "Show me the numeral that comes after three."
4. "Show me the numeral that is one more than the numeral eight."
5. "Show me the numeral that is one less than five."

CONCEPT: Number comparisons

Equipment:

Overhead projector
Small transparencies showing the words "greater than", "less than", and objects for the overhead projector

Activity:

Two sets of objects are formed on the overhead projector. They must have obviously different numbers of elements. Someone places the transparency showing "greater than", or the one showing "less than", between the sets to make a true statement.

****

Equipment:

Individual flannel boards
Objects
Flannel pieces showing words greater than, less than

Activity #1:

A set of objects is placed on the demonstration flannel board. The children than are told to form a set on their flannel boards that has "more" objects than the one on the demonstration board. After checking their results, the MIP asks them to form a set that has "fewer" characters. This can be repeated with different sets being placed on the demonstration flannel board. The phrases "greater than" and "less than" can also be used.

Activity #2:

Two sets of objects are placed on the demonstration flannel board--leaving a space between the sets. The children put the word card greater than or less than on their flannel boards, making a true comparison of the cardinal numbers of the two sets. Their boards are then held in the air for the MIP's observation.

CONCEPT: Greater than, less than

Equipment:

Two paper plates
Counters (blocks, sticks, discs, etc.)
Cards showing "more", "less", "greater than", "less than"

Activity #1:

A different number of counters is placed in each plate. A student puts the cards showing "more" and "less" on the plates having the most and the least number of counters. This is repeated several times, using different counters.

Activity #2:

Counters are put on the two plates. A child places the card showing "greater than" or the one showing "less than" between the plates, to make a true statement.

****

Equipment:

Magnetic board or flannel board
Objects
Flannel and magnetic pieces showing "greater than" and "less than"

Activity #1:

Two sets of objects are placed on the board. The phrase "greater than" or "less than" is put between the sets to make a true statement on the child may verbalize the statement.

Activity #2:

One set and one word card are placed on the board (e.g., ★★ ★★ less than.) A child forms a set to make this a true statement.

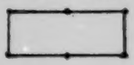
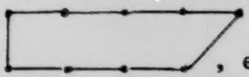
CONCEPT: Even and odd numbers

Equipment: Counting objects (cubes, sticks, discs, etc.)

Activity: Each child is given a set of counting objects. The number of objects may vary for different children. The children must determine whether they have an even number of objects or an odd number of objects. They are told that if they group the objects in pairs and there are no objects "left over", they have an even number of objects. If they end up with one object "left over", then they have an odd number of objects. Each student is asked to tell if he has an even or an odd number of objects and to state the number that represents the set.

****

Equipment: Geo boards and rubber bands, or pegboards and pegs

Activity: A rubber band is placed around some of the elements on the first two rows of a geo board (e.g.,  or , etc.). The children are asked to tell whether the number of nails enclosed is even or odd. They must do this without counting the nails. This will be easy if the child realizes that an even number of nails yields a rectangle. The rubber band will be stretched into the shape of a rectangle because of the groupings by twos. After a child has determined whether the number of nails enclosed is even or odd, he must give the cardinal number of the set. This should be repeated using several examples. If the pegboard is used, pegs are placed in the first two rows.

CONCEPT: Even and odd numbers

Equipment: Magnetic board
Flannel board
Objects

Activity: Several objects are placed either on the magnetic board or the flannel board. The students determine whether there is an even or an odd number of objects. This can be determined by grouping the objects in twos, as described in the introduction to this section. The children should also state the cardinal number of the set.

If individual flannel boards are used, each child should be given several objects.

****

Equipment: Overhead projector
Objects

Activity: Several objects are placed on the overhead projector. Then the procedure described in the preceding activity can be used.

****

Equipment: Individual chalkboards

Activity #1: The children are told to draw an even or an odd number of figures (△ , ✳ , ● , etc.) on their chalkboards for the teacher's observation.

Activity #2: The children are asked to write the numeral for an even or an odd number on their chalkboards. The answers are held up for all to see.

CONCEPT: Number comparisons - prime numbers

Equipment:	Magnetic board Magnetic numeral cards
Activity:	Place several one and two digit numeral cards on the magnetic board. Make sure some of the numbers are prime. A student should be asked to find a prime number on the board. Other students should be asked to identify prime numbers on the board until they have all been identified. Repeat the activity with different numerals and students.

****

Equipment:	Chalkboard or overhead projector
Activity:	Same as above except write the numerals on the chalkboard or overhead projector. The children then are asked to identify the numerals that represent prime numbers.

CONCEPT: Number patterns

quipment: Magnetic board
Magnetic numeral cards

Activity: Arrange four of the numeral cards in a partial sequence on the magnetic board.

$\boxed{3}, \boxed{6}, \boxed{9}, \boxed{12}$

Require a student to select the number card that would be the next numeral in the sequence, namely $\boxed{15}$. Repeat the activity using other partial sequences such as:

$\boxed{4}, \boxed{8}, \boxed{12}, \boxed{16}$, ____ or

$\boxed{16}, \boxed{14}, \boxed{12}, \boxed{10}$, ____ or

$\boxed{6}, \boxed{3}, \boxed{6}, \boxed{3}$, ____ or

$\boxed{1}, \boxed{3}, \boxed{5}, \boxed{7}$, ____

Vary the activity by leaving out one of the terms in the pattern.

e.g. $\boxed{6}, \boxed{12}, \boxed{}, \boxed{24}, \boxed{30}$ or

$\boxed{13}, \boxed{10}, \boxed{7}, \boxed{}, \boxed{1}$

Equipment: Overhead projector
Chalkboard

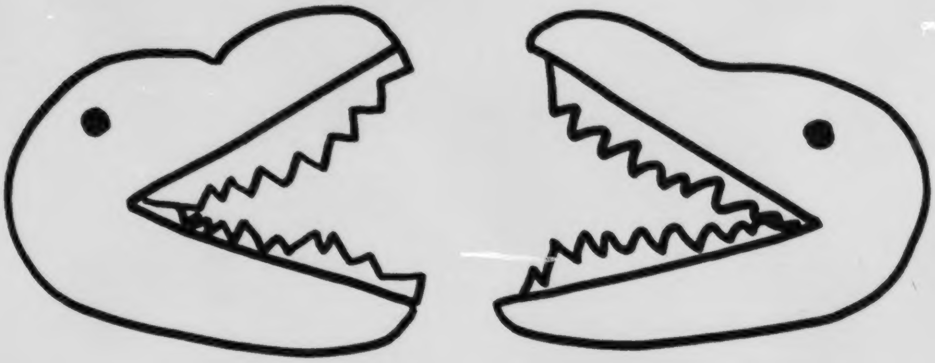
Activity: Same as above except write the partial number pattern on the overhead or chalkboard and ask the students to write the missing term in the missing spaces.

GREATER THAN, LESS THAN

Materials: 1 sheet colored cardstock, 8" x 10"
8 alligator heads to each sheet

Procedure: All alligators are printed on cardstock

Instructions: Each child is given a set of alligator heads. The MIP will give them two cards showing a number and she will ask them to show which is "greater than" or "less than". The one with the most cards is the winner of the activity.

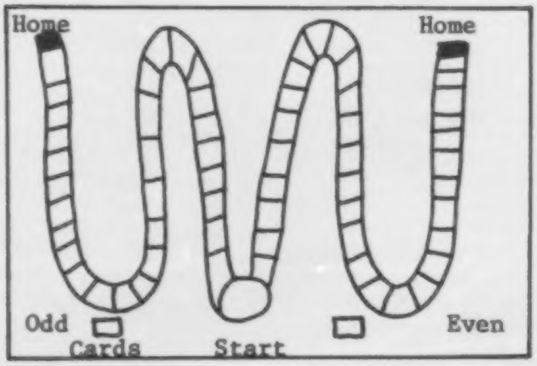


EVEN AND ODD GAME

Materials: 1 piece of tagboard 28" x 22"
50 cards 2" by 3"

Procedure: Draw and color your playing board as in the illustration below. Number each card 1 to 50. In the top right hand corner, mark 1, 2 or 3 to designate how many spaces the child may move for the correct answers.

Instructions: Each player chooses whether he will play on the odd side or the even side of the playing board. Shuffle cards and place on the square labeled cards. Each player draws a card from the deck. He may move the number of spaces indicated by the numeral in the top right hand corner, if the card has a number on it that corresponds to his side of the playing board. (i.e., the player on the odd side can only move if he draws a card with an odd number on it.) The object is to get to your home first.



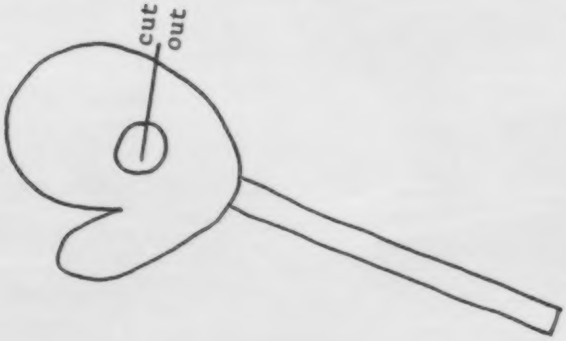
HUNDREDS BOARD AND MITT

Materials: 1 piece of tagboard, 50 cm x 50 cm for hundreds board
1 piece of tagboard, 20 cm x 45 cm for mitt

Procedure: Draw lines dividing the board into 100 squares. Each square will be 5 cm x 5 cm. Place the numerals as shown. Make a catchers mitt to be used to catch certain numerals.

Instructions: The teacher "catches" certain numerals and the children have to identify them. The mitt can be used to teach before, between and after, more than, less than - counting by 2's, 5's, 10's -- and also to teach even and odd.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



BEFORE, BETWEEN & AFTER

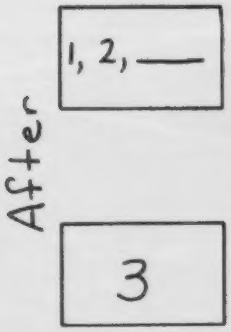
Materials: Deck of cards

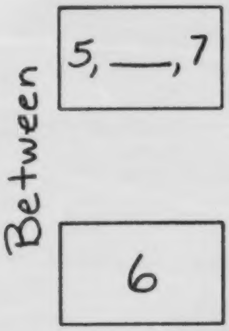
Procedure: 1/3 of the deck should contain "Before" Problems (i.e., ____, 9, 10). Put the answer "8" on the back.

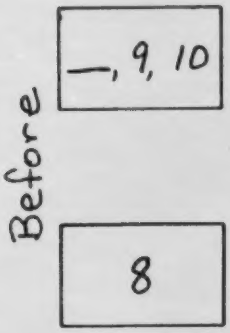
1/3 of the deck should contain "Between" Problems (5, ____, 7). Put the answer "6" on the back.

1/3 of the deck should contain "After" Problems (1, 2, ____). Put the answer "3" on the back.

Instructions: One child holds the cards while the other one responds. If he is correct, he gets the card, if not, it goes to the back of the stack.



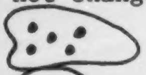
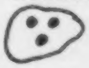
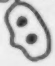
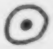
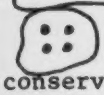




CONSERVATION OF SETS

Introduction

Number - Numeral

The principle of conservation of sets is that the cardinal number of a set does not change when that set is separated into two subsets. (E.g, The set  may be separated into the subsets  and  or  and  or their reversals)

The conservation of sets section of the skill sheet is subdivided into the categories (1-6), (1-12), and (1-18). You may want to gear your instruction to these varied subdivisions.

CONCEPT: Conservation of sets

Equipment: Counters (sticks, blocks, discs, buttons, etc.)

Activity: Each student receives a certain number of counters (3, 4, 5, 6, 7, etc.). He is told to arrange them in two sets, stating the total number of counters. All the students will then show how they have arranged the elements in the two sets. The activity should continue until all possible combinations of this set have been found. After each combination is found, the child must state the total number of the counters in the two sets. This number will remain constant.

****

Equipment: Individual geo boards
Three rubber bands

Activity: The children are to enclose a certain number of nails with a rubber band (e.g., six). The other two rubber bands are to be used to make two sets out of the set of enclosed nails (e.g., two and four). Each child then gives the set sentence for his geo board. (E.g., "Two nails and four nails makes six nails.")

****

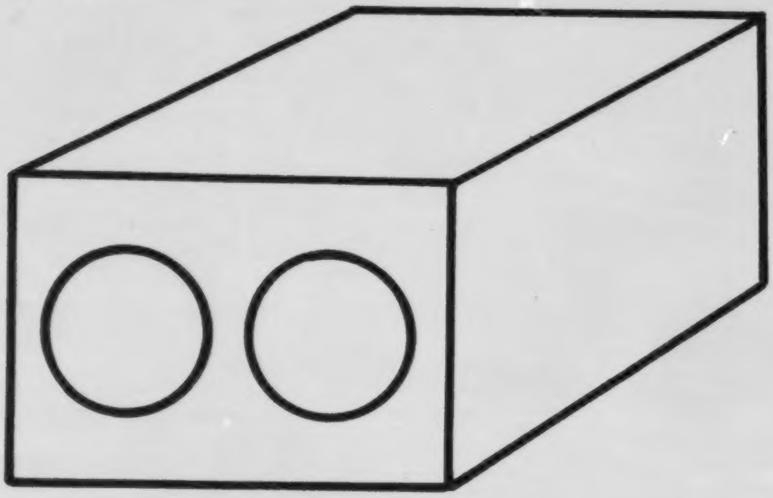
Equipment: Individual flannel board
Flannel shapes

Activity: Each child is given a set of shapes (3, 4, 5, 6, etc.) to use on his flannel board. The children are instructed to form two groups on their flannel boards, using the flannel shapes given to them. The MIP then walks around the room to observe the different groupings. He can hold up flannel boards with different groupings, or unusual patterns, for class recognition. It should be emphasized that the total number of objects remains the same, regardless of the groupings. This activity can be repeated using different sets. The children verbalize the set sentence associated with each of their solutions. When the child is older, and more mature, he can show the number sentence associated with the joining of the two sets, using his "show-me-board" or an individual chalkboard.

TACTILE BOX

Materials: One cardboard box (top included)

Procedure: The box is covered with construction paper. A hole large enough for a child's hand to pass through is cut in one end of the box. (Another possibility would be to cut two holes in the box so the child could place both of his hands in the box at the same time.) (Place textural objects as wood chips, hair roller, rocks, pieces of rope, etc.)



*Variation: PANDORA'S GOLDEN LIFESAVER
Label each item with a math problem. Attach "scary" signs on box (i.e., "It Got Me," "Help," "Will It Bite," etc.)

EQUIVALENT SUBSETS

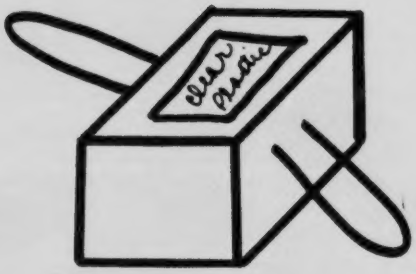
Rings 'n Things may be further adapted by using additional rings and having children put an equal number of counters in each ring. The teacher would ask how many are in each set and how many there are altogether. This activity of equivalent subsets precedes the concept of multiplication.

CONSERVATION BOX

Materials:
1 small box
1 tongue depressor
1 parquetry chips
Clear contact paper

Procedure: A hole is cut into the lid of the small box and covered with clear contact paper. A tongue depressor is fitted through the box and parquetry chips are placed on each side of the depressor. Each child has a box.

Instruction: A number of parquetry chips are placed on each side of the tongue depressor. Each child will shake his box and the teacher will ask how many are on each side of the depressor and how many there are altogether.



JOINING SETS

Introduction

Joining sets is a natural activity for kindergarten children. The learning of addition begins by having the students handle objects. They first identify the number of objects in the sets that are to be joined, and then the number of the set that is formed. Essentially, the child learns to verbalize addition statements, such as, "A set of two blocks joined with a set of three blocks makes a set of five blocks."

In the above statement, the child is learning to verbalize "addition facts" by learning to "associate" cardinal numbers with their sets. At the kindergarten level, the child verbalizes addition. When he enters first grade, he learns to read and write what he has been saying.

Set and number operations, though relative, are not the same. When students work with objects they should think in terms in joining and separating sets, using appropriate words, such as, "join", "take away", "remove", and "leaves". When working with numbers, students should think in terms of addition and subtraction, using such words as add, subtract, plus, minus, and equals. For example:

Set sentence - A set of two dogs joined with a set of three dogs makes a set of five dogs.

Number sentence - Two plus three equals five

As a culminating activity, MIPs may write experience charts with children dictating story problems. Story problems may be duplicated for all children.

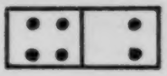
CONCEPT: Joining sets - verbal response

Equipment: Two trays
Counters (blocks, discs, cubes, buttons, bottle caps, etc.)

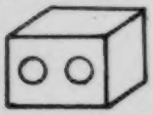
Activity: A set of counters is put in each tray. One pupil is chosen to state the number of counters in each set and the total of the two combined sets. This activity can be repeated with different sets and counters.

****

Equipment: Cards showing domino patterns
Counting discs

Activity: The MIP exposes a domino card to the class. Each member of the class makes a copy on his desk, using the counting discs. The children then respond by giving verbal descriptions of the joining of these sets. (E.g.,  - the response would be, "Four and two makes six.")

****

Equipment: A box having two holes large enough for a child's hands to be inserted  , counting blocks, cards showing numerals or sets.

Activity: Several blocks are placed inside the box. One child can then put his hands inside the box and pull out a certain number of blocks, holding some in each hand. The number that he is to pull out may be stated verbally or it can be shown with a flash card.

CONCEPT: Joining sets

Equipment: Magnetic board
Magnetic objects

Activity: A set of objects is placed on the magnetic board (3, 4, 5, 6, 7, etc.). It is separated into two sets. One child may then give a verbal description of the set sentence associated with the two sets. (If the sets are (★ ★) and (★ ★ ★), the child should say, "Two stars and three stars makes five stars.") Other groupings might be (★) and (★★★★), ( ) and (★★★★★), (★★★) and (★★), or (★★★★) and (★). Each time, the child should be required to give a verbal description of the set sentence for the new grouping. At a later stage of development, the child can be required to give a number sentence for the grouping.

****

Equipment: Flannel board(s)
Objects

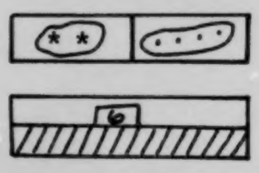
Activity: Two sets of objects are formed on the flannel board(s). The children are to verbalize the cardinal number of each set and the number associated with the combined sets. (E.g., (★ ★) (★ ★ ★). The child should say, "Two stars and three stars make five stars.")

****

Equipment: Individual "show-me-boards"
Cards showing numerals
Flash cards showing two sets to be joined

Activity: Each child is given a deck of cards showing numerals. The MIP holds up a flash card for all to see. The children are to select from their decks, the card with the correct numeral for joining the sets.

(E.g.,



CONCEPT: Joining sets

Equipment:

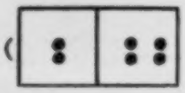
Chalkboard
Individual chalkboards

Activity:

A set is formed on the chalkboard (3, 4, 5, 6, or more elements). The children are then asked to make two sets on their individual chalkboards, with the two sets having a total number of elements equal to the set on the chalkboard. Recognition should be given to those having different combinations. This can be done by holding their chalkboards in the air for all to see. The children are asked to verbalize the set sentence for each combination. A different set can be put on the board and the above procedure repeated.

* * *

Equipment:

Overhead projector
Transparencies showing domino patterns ( , etc.)
Sheet of construction paper

Activity:

A transparency is placed on the overhead projector. Half of the transparency should be covered with construction paper; half should be exposed. The children are to state the cardinal number of the set that is shown. The paper is then removed so the other half shows. The cardinal number of this set should be stated, then the two can be joined and the cardinal number of the combined sets can be given. This should be repeated with several transparencies, showing many different sets.

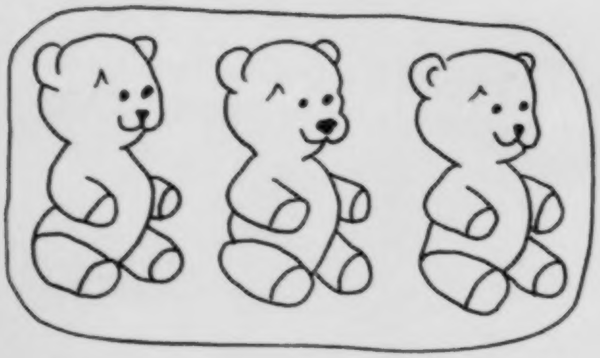
JOINING SETS

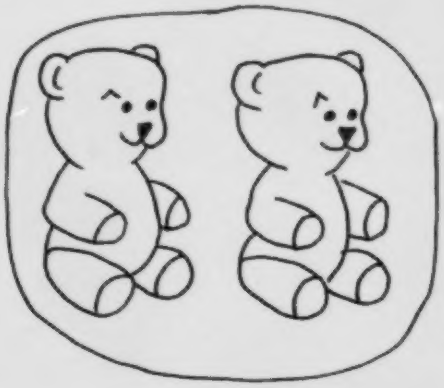
Materials: Bear Set Cards
Number word cards

Procedure: Make bear set cards 1-9. Color bears red, green, blue and yellow.

Activity: Each child will draw a number word card. They will then select two bear set cards to make the correct number sentence.
(3 bears + 2 bears = 5 bears.)

The child receives a colored chip each time the correct number sentence is given.





RINGS 'N THINGS

Rings made from tagboard have been found to be very useful in reinforcing a variety of concepts. Below are a few activities in which the rings play an important role.

JOINING SETS AND CONSERVATION OF NUMBER

Each child is given two rings and a certain amount of blocks. The children are told that they must use all of the blocks designated to form two sets. For example: "We will work with five blocks. Let's think of this as the 'five' family. Using your five blocks, put some in one ring and some in the other.

Different children then tell what subsets they have formed, such as "I have two blocks on the left and three on the right." Children are encouraged to name their subsets from left to right.

Questioning is important. The MIP might ask, "How many are two and three altogether?" Do two and three make five? What else makes five?

This activity not only reinforces joining of two sets, but also conservation f number and the concept of "number families." Number sentences, either itten or verbal, come with the children's readiness, and formal number sentences using the terms "plus" and "equals" are used when the children fully understand the concept of joining sets.

DOMINO DRAGON

(Put the correct number of
spots on the dragon)

Adapted from a game designed at the Pacific Science Center.

Number of players: 2 to 4

Materials needed:

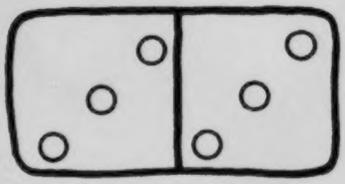
Domino dragon board
One set of double-six dominoes.
(Can also be played with double-nine dominoes)

Procedure:

Spread the dominoes face down on the playing surface. Each player draws four dominoes and places them face up in front of him. Let the player with the highest domino be the first to play. He places his highest domino in the "S" position on the dragon board.

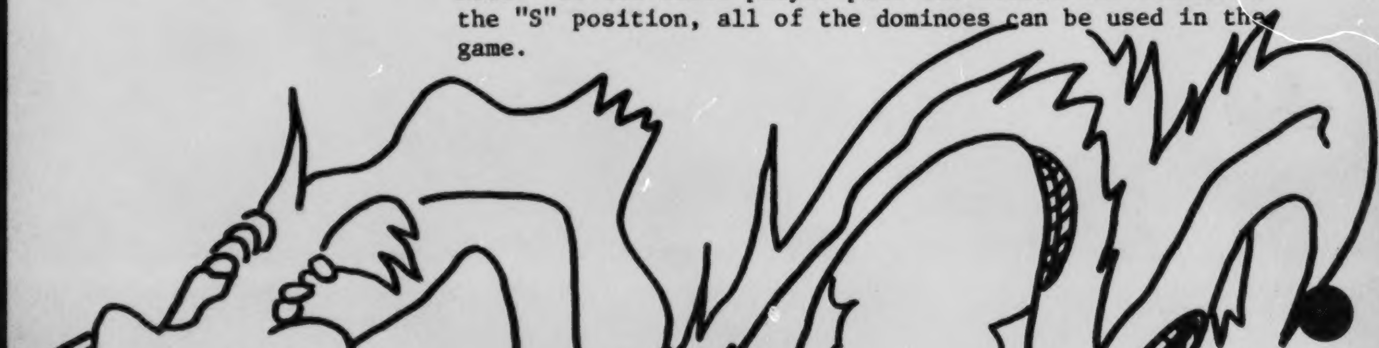
The domino placed in the "S" position determines the number of spots on the dragon for this game. For example, if the domino is the six-four, then the game is "construct a ten-spot dragon."

The next player tries to play one of his four dominoes to the right or left of the "S" position so that the number of dots in a straight row add to ten. (There are places to play a domino and three addends from three squares to get a sum of ten.) If the player cannot make a legal play, he draws a penalty domino from the playing surface and passes to the next player. Play continues, each player attemtping to get a sum of ten on three squares, and if unsuccessful, passing and drawing a penalty domino. If a player draws a domino with more than ten dots on it, in this game the domino would be discarded and the player would draw again.



The winner is the first player to get rid of all of his dominoes, or in the case that no one is able to do this, the winner is the last person to make a legal play.

Note: If the first player puts the double-six domino on the "S" position, all of the dominoes can be used in the game.



ADDITION FACTS

Introduction

Learning addition begins by having the students handle objects, forming sets that later will be replaced with numbers. They first identify the number of objects in the sets that are to be joined, and then the number of the set that is formed. Next, they are introduced to the words "plus" and "equals", and finally to the mathematical symbols + and =, and the equation form for addition.

Basic addition facts involve the renaming of two addends less than ten. All addition combinations can be derived from the basic facts. There are 100 different addition combinations involving the numbers zero through nine. These facts may be reduced to 45 different combinations, through the application of two ideas.

First, the 19 facts involving zero as an addend need not be learned separately, since they are based on the identity principle of addition. Once the student realizes that zero added to any number results in that same number, there is no need to treat each fact involving zero as an addend, as a new idea.

Second, the use of the identity element leaves 81 separate facts to be learned. Of these, 72 can be reduced to 36 different facts by application of the commutative principle. (E.g., if the student learns 3 + 2 = 5, he does not have to learn 2 + 3 - 5 as a new fact.) These 36 facts, plus the nine "doubles" facts (e.g., 2 + 2 = 4, 3 + 3 = 6, etc.), form 45 separate basic addition facts to be learned.

Since knowing the basic facts is an absolute necessity for proficiency in mathematics, it is important to stress reinforcement until knowledge of the facts is achieved. This section is full of games and contests whereby the child is given ample opportunities to practice these basic facts.

Culminating the study of addition facts is the concept of conservation of numbers meaning there are several addition facts which have the same sum. This is often referred to as "number families".

MIP may also write experience charts with children dictating story problems. Story problems may be duplicated for all children.

NOTE: If a child demonstrates an understanding of the + and = symbols when doing the activities on pages 100-102, record this as mastery for the (+) symbol on his skill sheet.

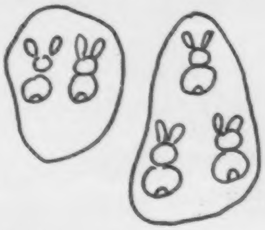
CONCEPT: "Plus"

Equipment:

Overhead projector
Magnetic board
Flannel board or chalkboard
Counting objects (discs, cubes, etc.) or objects to be used on one of these teaching aids

Activity:

Using one of the above teaching aids, form two sets that are to be joined, such as:



The students must express the joining of these sets with a mathematical phrase. For the above sets, it would be 2 + 3. They should use only verbalization at this stage, and this particular activity should be used over a period of several days.

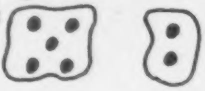
****

Equipment:

Overhead projector
Magnetic board
Flannel board or chalkboard
Objects for these aids
Individual chalkboards

Activity:

Two sets are formed on one of the above teaching aids. For example:



The children will express, mathematically, the joining of these two sets, using the individual chalkboards to record their responses. For the above example:

5 + 2
Individual chalkboard

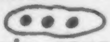
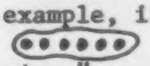
****

CONCEPT: Number sentence

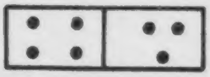
Equipment:

Overhead projector
Magnetic board
Flannel board or chalkboard
Objects for these aids
Flash cards showing two sets, or large dominoes showing two sets

Activity:

The two sets that are to be joined are exposed to the class. The children are to respond, verbally, by giving the number sentence associated with the joining of the two sets. For example, if the following two sets were exposed,  , the children would say, "Three plus six equals nine."

Equipment: Chalkboards

Activity: The children are instructed to make dominoes (e.g., ). When they have finished, the children will come to the front of the room, expose their domino to the class, and tell the domino's story. For the above example, a child would respond with this sentence, "Four plus three equals seven."

****

CONCEPT: Joining sets - verbal

Equipment: None

Activity: The MIP makes a verbal statement, such as the following: "I would like to join together a set of two dogs and a set of five dogs. Tell me the number sentence associated with the joining of these two sets." The child would reply, "Two dogs plus five dogs equals seven dogs."

CONCEPT: Addition facts

Equipment: Flash cards showing addition problems

Activity: The children are arranged in a semicircle. A card is then flashed to a certain child. If the child answers the problem correctly, he may keep the card. The child with the most cards at the end of a stated time is declared the winner.

****

Equipment: "Show-me-boards" (cards showing numerals - the plus (+) symbol, the equals (=) symbol)
Flash cards showing addition problems

Activity: Each child is given a "show-me-board" and a deck of cards. A flash card, showing an addition problem, is exposed to the class. The children must form a number sentence for this problem on their "show-me-boards". They then hold up their "show-me-boards", with the completed sentence, for the teacher's observation.

****

Equipment: Individual chalkboards

Activity: An addition problem is written on the chalkboard. The children copy the problem on their chalkboards and find its solution. Their chalkboards are then held in the air for for the MIP's observation.

****

Equipment: Individual chalkboards

Activity: The children are asked to write on their chalkboards a number sentence whose answer will be a number stated by the MIP. (E.g., "Form a number sentence whose answer is seven.") The children then hold up their chalkboards for the MIP's observation. Different solutions are recorded on the chalkboard until all combinations are found.

Equipment: Chalkboard

Activity: Two children are chosen to work at the chalkboard. They are given an addition problem to solve. The first one to get the correct answer is the winner of the first contest. The winner then chooses someone to compete against him in the next contest. A new problem is given and the winner determined. The winner of each contest remains at the board and chooses his next opponent. When the period is over, the grand winner is the person who was involved in the most contests.

****

Equipment: Flash cards showing addition problems

Activity: The flash cards are placed in the chalk tray so all the students can see them. The class is divided into two teams. Two students, one from each team, stand behind a line drawn 10-15 feet from the chalk tray. The MIP then states a number (e.g., ten). The student that is first to walk to the tray and pick up a flash card (whose answer is this number) is allowed one point for his team. For the example above:

$$\boxed{\begin{array}{r}4\\ \underline{+6}\end{array}} \quad \boxed{\begin{array}{r}3\\ \underline{+7}\end{array}} \quad \boxed{\begin{array}{r}1\\ \underline{+9}\end{array}}\text{, etc.}$$

The team that has the most points at the end of the contest is declared the winner.

****

NOTE: The Games and Teaching Aids Book is filled with suggestions of devices that can be used to reinforce the addition facts. These games will serve as motivators for the necessary drill associated with learning the addition facts. They make learning the facts enjoyable. Stay with these games and facts until the student has a mastery.

CONCEPT: Number line

Equipment:	Overhead projector Overhead projector pencil Transparencies showing number lines
Activity:	A transparency showing a number line is placed on the overhead projector. A child goes to the projector and works out a problem that has been stated (verbally) by the teacher. The child will then draw his solution on the number line. The problems may be addition, subtraction or multiplication, depending upon the maturity of the children.

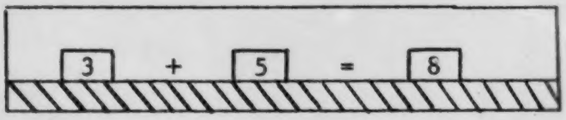
CONCEPT: Conservation of numbers

quipment: Individual flannel boards
"Show-me-boards"
Cards for boards (numerals 1-10 and symbols for plus and equals)

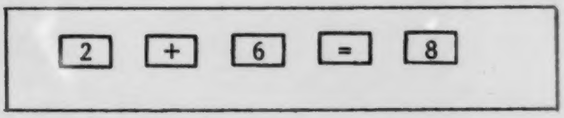
Activity: A number is either shown to the class or verbalized by the MIP. A number sentence, whose sum is this number, is then formed by the students on their "show-me-boards", or on individual flannel boards. (e.g., the teacher exposes "8" to the class, and the children form one of the following number sentences on their boards:

0 + 8 = 8, 1 + 7 = 8, 2 + 6 = 8, 3 + 5 = 8, 4 + 4 = 8,
5 + 3 = 8, 6 + 2 = 8, 7 + 1 = 8, 8 + 0 = 8

"Show-me-board"



Flannel board



After having formed one sentence, others having the same sum can be formed, until all combinations are found.

****

Equipment: Individual chalkboards

Activity A number is either shown to the class or verbalized by the MIP. The child writes a number sentence for this number, either as a sum on his chalkboard or on his paper.

****

CONCEPT: Number line addition

Equipment: Demonstration number line

Activity: The MIP says, "There are four girls and two boys at the reading table. How many students are at the reading table?" (six) Four girls are then shown on the number line. "The spaces between the numbers each represent one girl. We can also call these spaces 'units'. We have represented four girls by using four units on the number line. We can show the addition of the two boys by moving to the right two spaces, or two units. When we use the number line to show addition, we move to the right in the direction of the greater number. Where did we stop? (at six) Are there six students at the reading table? How can you show that this is right?" (The class can count the children.) Other addition problems should be worked on the number line, using units to represent pairs of numbers.

****

CONCEPT: Number line - addition or subtraction

Equipment: Number line on floor

Activity: The number line is placed on the floor. The children are told that to add, one moves to the right, and to subtract, one moves to the left. They can then solve number problems by walking on the number line. (e.g., if the child is given the problem $6 + 4 = \square$, he starts at six and walks to the right four places. He ends up on 10, which is the answer to the problem.) Every child should have an opportunity to solve a problem.

****

HOT DOGS AND BUNS

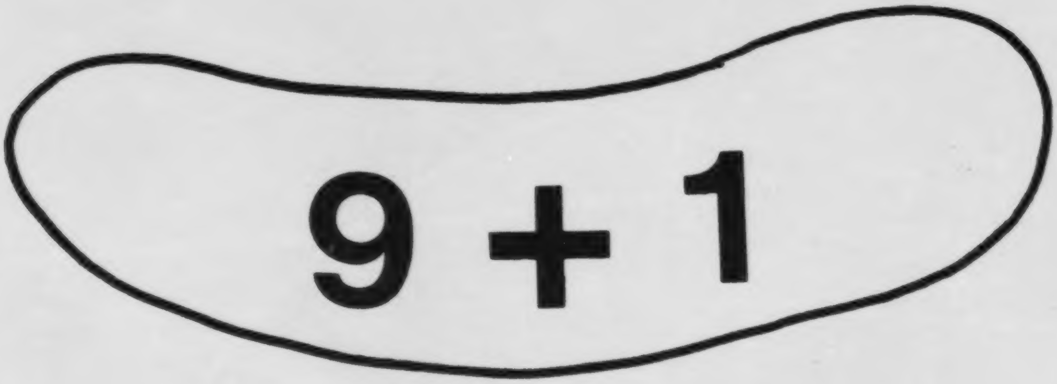
Materials: Construction Paper (brown and red)
Add facts 1 - 20

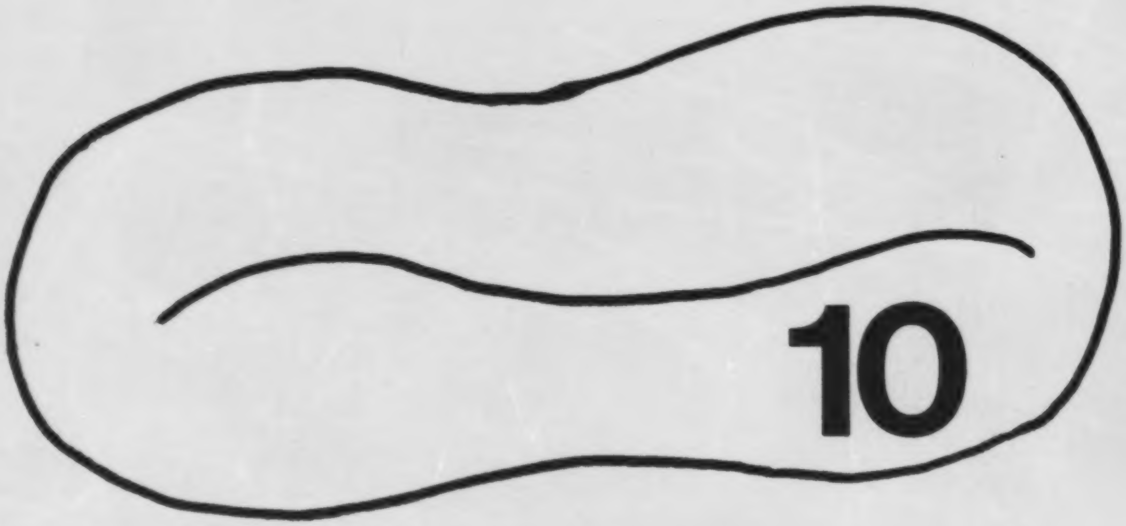
Procedure: Cut 20 hot dogs (red paper)
Cut 20 buns (brown paper)

Addition facts 1 - 20 on hot dog
Answers on buns

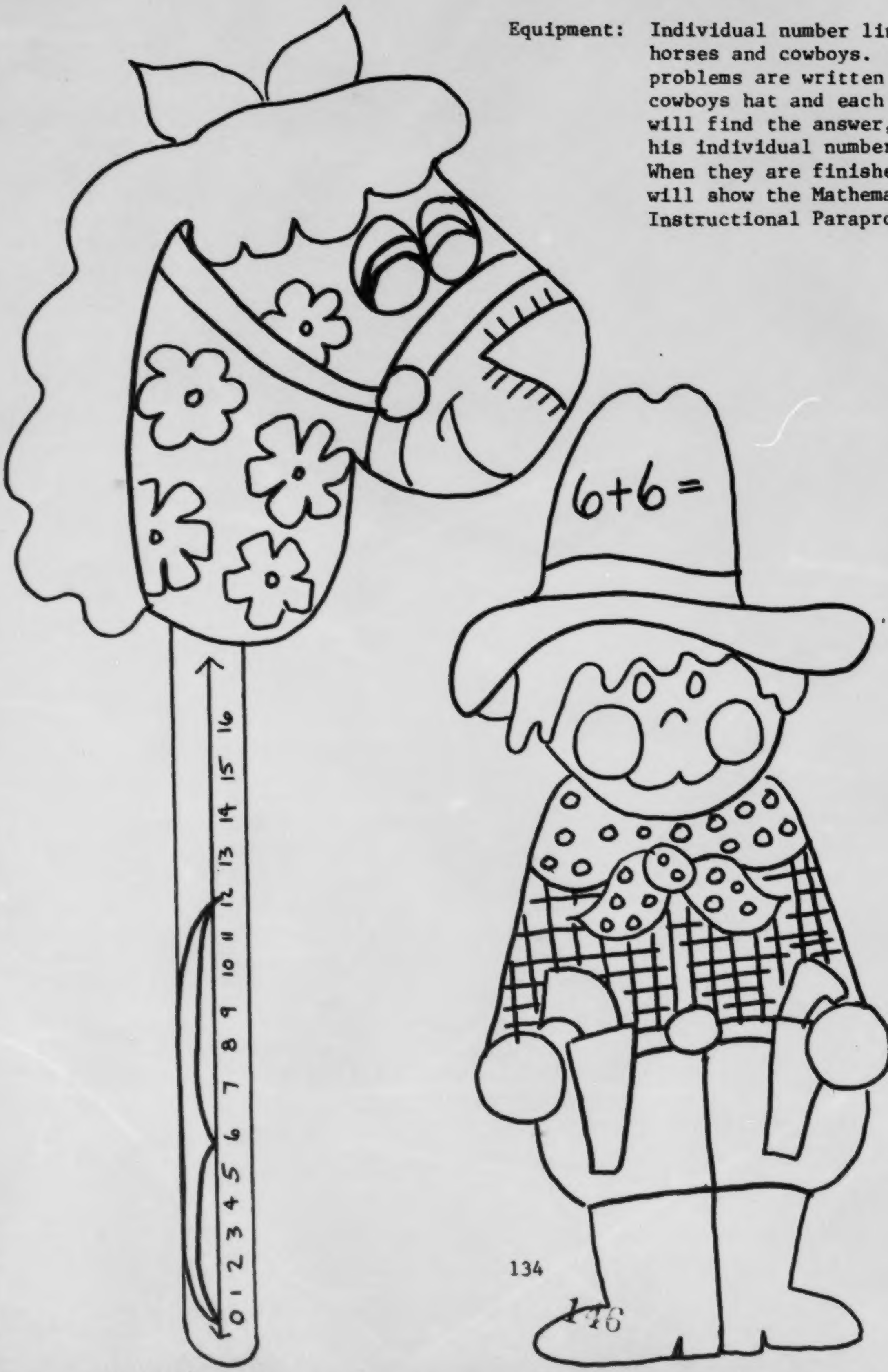
Activity: Each child takes his or her turn matching a hot dog to a bun.

One with most hot dogs and buns is the winner.





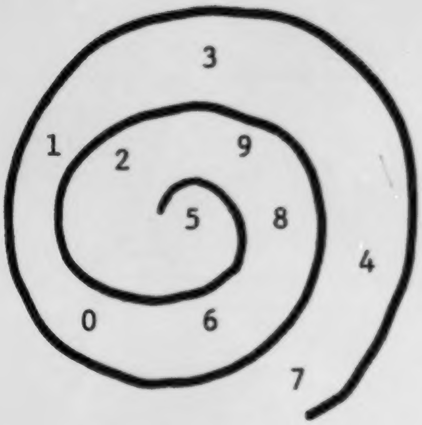
Equipment: Individual number line, stick-horses and cowboys. The problems are written on the cowboys hat and each child will find the answer, using his individual number line. When they are finished, they will show the Mathematics Instructional Paraprofessional.


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
6+6=

BEAT-THE-CLOCK #2

Materials: Chalkboard

Procedure: Draw a spiral, as shown below, with numbers 0-9 placed randomly in the pathway.



Instructions:

1. The children are told that the object of the contest is to see who can get to the center of the spiral first.
2. One child at a time starts at the arrow and moves through the spiral multiplying or adding each number that the Mathematics Instructional Paraprofessional has given him/her (e.g., three).
3. Time each child in seconds.
4. Declare a winner after six students have had a turn.
5. A contest between the winners can be held at the end of the period to determine the grand winner.

HAPPY HIPPO

Materials: one large tag board
one spinner
1 package colored discs (four colors)

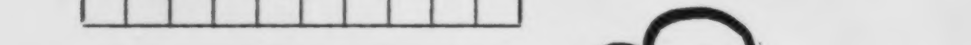
Procedure: One large game board shaped like a hippo with game board in center. One small hippo made like a spinner.

Instructions: Player spins the spinner; blocking out any two numerals in the same row; when added together they will make the number you have spun. The rows maybe vertical, horizontal or diagonal.

game board

9	3	1	9						
6	6	5	3						

Spinner

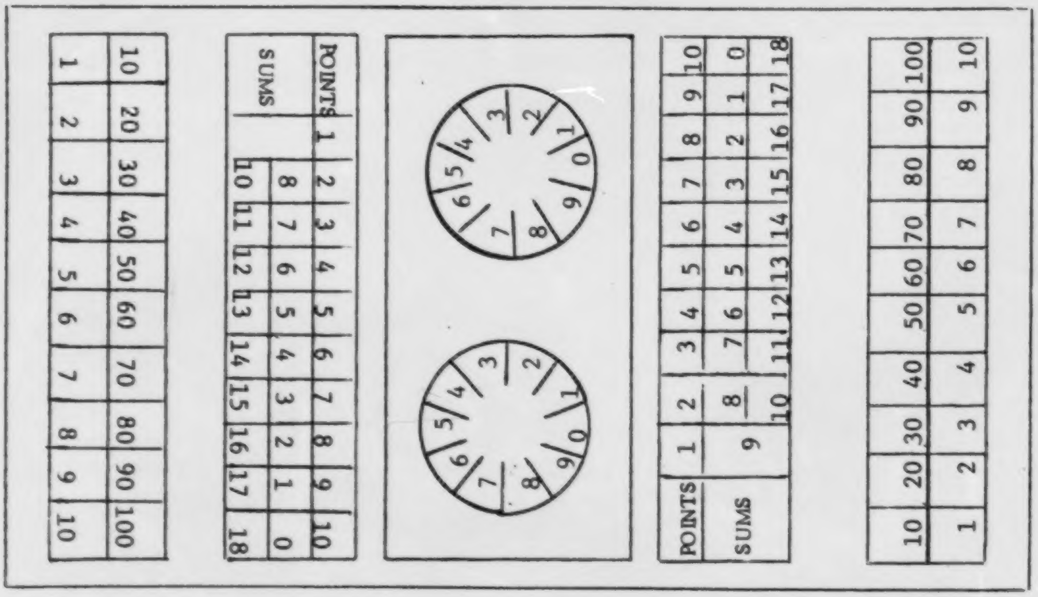


SPIN-A-FACT, Addition

This is a basic facts-level game. Players spin the spinners, obtain sums, and keep track of their scores on the scoreboards. The game is made more interesting by the "weighting" of the various products with respect to the point score. The number of points awarded for each sum is inversely proportional to the probability of obtaining that sum. This means that more points are awarded for sums that occur less frequently than for sums that are more likely to occur.

Game materials:

A scoring chart, scoreboard and 2 scoring markers are needed for each of the 2 - 4 players. One spinner set is required. A 2-player lay out is pictured below.



Game instructions:

1. Each player spins a spinner. The player who spins the highest number plays first. The player to his left is next and so on.

2. Players take turns. Each player spins both spinners and finds the sum. He finds the number of points for the sum on the scoring chart and records his total score on his scoreboard.

3. The first player to score 100 points is the winner unless two or more players score 100 points in the same round. In this case, the player with the greater score wins. In case of a tie, those players will spin again to determine who is the winner.

The score shown on the scoreboard pictured below is 87.

10	20	30	40	50	60	70	0	90	100
1	2	3	4	5	6	0	8	9	10

99

Materials:
1 deck of cards
4 each of 1-10
4 each of 2 different symbols
4-99 cards
10 chips for each player

Procedure:

Object of the game is to get a total of 99 and force a player not to be able to play a card.

1. Deal 3 cards to each player.
2. Put remaining cards face down in center of table.
3. Each player receives 10 chips.
4. Player to left of dealer begins play.
5. Players keep a running total of cards played.
6. Special cards are used as follows:

   4 - Reverses play
   10 - Subtract 10 from total
   9 - Keeps score the same
   99 - Automatically makes score 99 (4-9 or 10 will be only cards that can be played!)

7. Player who is unable to play a card loses and must give each player a chip.
8. Player with most chips is the winner.

TWINKS

Materials:

Deck of 6C cards (3" x 5")
Cards numbered 0 - 15
(There will be 4 sets)

Procedure:

Give each player an equal number of cards. They each should place their deck face down in front of them. The first player turns over a card and puts it in the center of the table in front of himself. This play continues similarly for the remaining players. As soon as anyone sees that the sum of the two or more exposed cards equals 15, he calls out "Twinks" and forms a book of the set of cards involved. The cards that were in the center and not used for this set of 15, remain in the center. If, after three turns, no books are made, each player takes back his cards and places them on the bottom of his pile and the game continues. The child with the most books is the winner.

Note:

The "Twinks" number can be changed by pulling out the unnecessary cards. (e.g., if "9" is used for "Twinks", remove the 10-12-12-13-14- and 15 cards.)

BUG YA

Materials: 2 - cubes
container (box, can etc.)
scratch paper for scoring

Procedure: Put a bug on one side of each cube. (Hallmark makes a cute bug sticker.) Put numerals 2 and 5 on opposite sides, put 3 and 4 on opposite sides, put 1 opposite the bug. (Note: you will have to use larger numerals for the larger addition facts.)

Instructions: Each child takes turns rolling his set of cubes. He keeps a running score of his total.

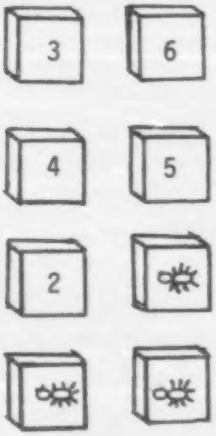
If one bug comes up, child sbutracts the number from the total score.

If both bugs appear, child loses total score.

Use 2 cubes for each couple playing.

First child to reach 100 is winner.

Example:



add 9

add 9

(subtract 2)

(lose total score)

SCORE
9
+9
18
-2
16
-16
0

Concepts: Reinforce addition and subtraction. (Can be used for multiplication by multiplying cubes instead of adding. Subtract as above.)

The small child can play this by keeping track of his score with quiet counters. After 3 times around, each child counts the number of counters he has. The one with the most is the winner.

SEPARATING SETS

Introduction

A child must "reverse" his thinking to think of subtraction as the opposite of addition. Once the ability to think of subtraction as the opposite of addition is established, the child has little difficulty in learning the subtraction facts.

Sets of objects on the flannel board can be used to present examples of set removal. For example, the Mathematicas Instructional Paraprofessional can place four cutouts of oranges on the flannel board and tell the class he is going to remove two. The class is then asked how many will be left out of the four that were in the original set. The students should determine that the Mathematics Instructional Paraprofessional started with a set of four, and that he removed, or separated, a set of two from the original set, and now there is a set of two remaining. The words, "removing" and "separating", should be used as frequently as possible so that the class becomes familiar with their meaning. Although the subtraction operation is not actually being taught at this time, a basis for its introduction is being provided.

Concept: Separating Sets

Equipment: Tray, counting objects (cubes, beads, discs, sticks, etc.)

Activity: Several objects are placed on the tray so that all the children can see them. The children are questioned concerning the cardinal number of the set. Some of the objects are then removed. The children are to discover how many objects remain. They should give a verbal description of what has taken place. (E.g., "Seven blocks take away three blocks leaves four blocks.") This can be repeated, using the same number of objects, but taking away a different number.

****

Concept: Separating Sets

Equipment: Flannel board, flannel objects, piece of yarn

Activity: The yarn is placed on the flannel board so a closed figure is formed. Several objects are placed inside the figure. The children then state the number of elements in the set. Some of the elements are removed from the set. A child can then state the cardinal number of the remaining set.

****

Concept: Separating Sets

Equipment: Individual chalkboards

Activity: The children will form a set of triangles on their chalkboards. For example, the Mathematics Instructional Paraprofessional may say, "Draw six triangles on your chalkboard." The children are then told to cross out a certain number of these triangles and to determine the number of remaining triangles. The Mathematics Instructional then says, "Draw an "x" on two of the triangles. Now how many do you have left?" The children must give a verbal description of what has taken place. (They might say, for example, "Six triangles cross out two triangles leaves four triangles.")

****

oncept: Separating Sets

Equipment: Overhead projector, objects, pennies

Activity: Several pennies, or objects, are placed on the overhead projector, The student is required to state the cardinal number of the set. Some of the elements are then removed, thereby making a smaller set. One child can give the cardinal number of this smaller set. Another one should give a verbal description of what has taken place.

****

Concept: Separating Sets

Equipment: Overhead projector, overhead projector pen, acetate roll

Activity: A set of objects is drawn on the acetate roll. The Mathematics Instructional Paraprofessional then makes up a story which will warrant the removal of some of the elements of the set. The children then determine the number remaining. They must give a verbal description of what has taken place. (For example, the Mathematics Instructional Paraprofessional draws six rabbits on the overhead projector, and then crosses out two - saying they hopped away. Four rabbits are left. The verbal statement made by the child would be something similar to the following: "If you had six rabbits and two hopped off you would have four left".

****

Concept: Separating Sets

Equipment: Overhead projector, prepared transparencies

Activity: Several transparencies, showing different sets, are prepared in advance. A transparency is then placed on the overhead projector. One child states the cardinal number of the set. Next, some of the elements of the set are either crossed out or covered, so that the image to the screen is blocked. These will be the elements removed from the set. A child then makes a verbal statement as to what has taken place.

****

Concept: Separating sets

Equipment: None

Activity: The children are to look for sets that can be separated. For example:

1. "There were ten students playing ball. Three went to get a drink of water. How many stayed?"
2. "John had six candy bars. He ate one. How many does he have left?"
3. "Susan had eight pieces of candy, but she lost three of them. How many pieces of candy does she have left?"
4. "Fred caught seven fish, but three of them flopped back into the lake. How many did he have left?"

****

WORMY APPLE

Materials:	tagboard apples
Procedure:	On the back of each apple place, shapes, configurations, numerals, etc. On the backs of one or two apples, draw a worm. Use red, green and brown markers to design the front of each apple.
Instructions:	Place the deck of apples on the table with the apple side up. Each player selects an apple. If the child gives a correct response for the problem, he may keep his apple. Those apples the child can not respond to correctly and the wormy apples go back into the pile. The player with the most apples at the end of the contest, wins the game.

TURTLE TOSS
(sets)

Number of players: 4 players

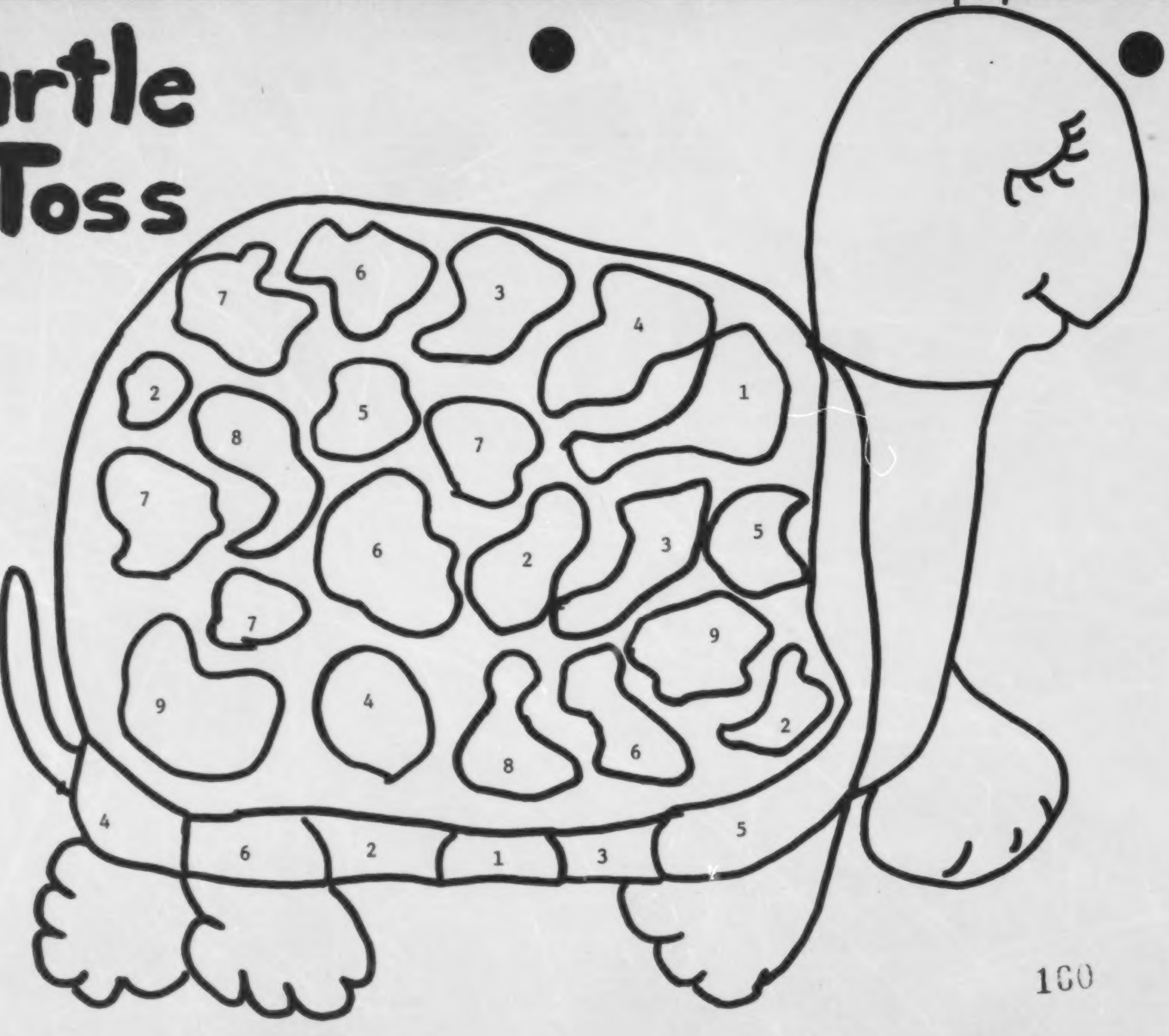
Materials: 2 quiet counter or 2 pennies

Procedure: Player #1 tosses the pennies on the turtle. He then adds the 2 sets together and tells the number sentence. (2 and 3 is another name for 5.) If the other children agree, the player may take a token.

Player #2 has a turn; play continues until all four players have had a turn. They need to have 3 turns and then count their counters. The one with the most is the first winner; the next most is the next winner, etc.

Note: This can be used for set recognition -- (use one penny), numeral recognition (use numbers instead of sets). The game can also be used for separating sets. The child says,"8 - 1 = 7."

Turtle Toss


7
6
3
4
2
8
5
7
1
7
6
2
3
5
7
9
9
4
8
6
2
4
6
2
1
3
5

147

100

SEPARATING SETS

Each child is given one large ring. The children are told to put a given number of blocks into the ring. They must be sure that they have put in the designated number of blocks. They are then told to "take away" a given number. "How many blocks do you have left?" Can anyone give me the number sentence for what we just did?

The terminology might, at this point still be very simple, such as, "Five take away two leaves three." Formal number sentences using the terms "minus and equals" are used when the children fully understand the concept of separating sets.

Rings 'n Things may be further adapted by using additional rings and having children put an equal number of counters in each ring. The teacher would ask how many are in each set and how many there are altogether. This activity of equivalent subsets precedes the concept of multiplication.

SUBTRACTION FACTS

Introduction

Learning subtraction begins by having the students handle objects, forming sets that later will be replaced with numbers. They first identify the number of objects in a set, then the number associated with a portion of the set that is to be taken away, and, finally, the number of objects remaining in the set. Then they are introduced to the words "minus" and "equals", later to the mathematical symbols - and =, and last to the algorism for subtraction.

Subtraction can be taught by using two different methods. One method is renaming (once called "borrowing"), and the other method is by equal additions. How can this example be done?

$$\begin{array}{r} 91 \\ \underline{-24} \\ 67 \end{array}$$

Regrouping is used if it is done this way: $11 - 4 = 7$ (ones); $8 - 2 = 6$ (tens). If a person asks himself, "What number added to 24 equals 91?" he is using the equal addition method.

Since knowing the basic facts is an absolute necessity for proficiency in mathematics, it is important to stress reinforcement until knowledge of the facts is achieved. The section on subtraction concepts is full of games and ctivities which will reinforce the basic subtraction facts.

The equipment used to reinforce the addition facts may also be used to reinforce the subtraction facts. All that needs to be done is to change the addition problems to subtraction problems.

Concept: Number line - subtraction

Equipment: Large number line on floow

Activity: The number line is taped to the floor. Someone then stands on a certain number (e.g., six). This student states the number and then walks backward two places (thereby getting a smaller number). The child is then required to state the number he is now standing on and describe what has taken place. "I started on eight, walked backward two places, and now I am on six." This activity is repeated with different children and different instructions.

****

Concept: "Minus"

Equipment: Some method of forming a set (counting objects, flannel board, magnetic board, overhead projector, flash cards)

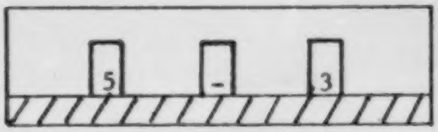
Activity: A set is formed by using one of the methods described above. Some of the elements are then removed from the set. The children should verbalize what has taken place, using the term, "minus" at this time. (e.g., Seven objects are placed on the magnetic board, four of them are removed. The child's response should be, "seven minus four".

****

Concept: "Minus"

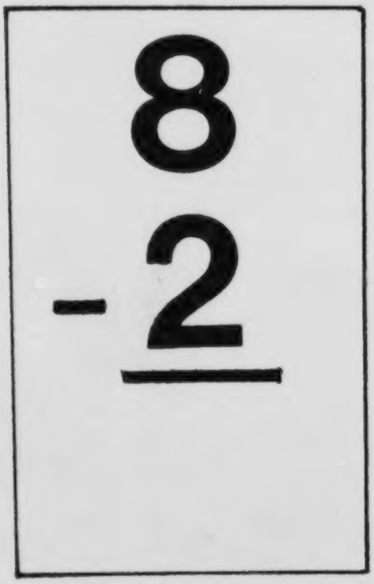
Equipment: "Show-me-boards", cards showing numerals and the minus symbol, some method of forming a set (counting objects, magnetic board, flannel board, overhead projector, flash cards)

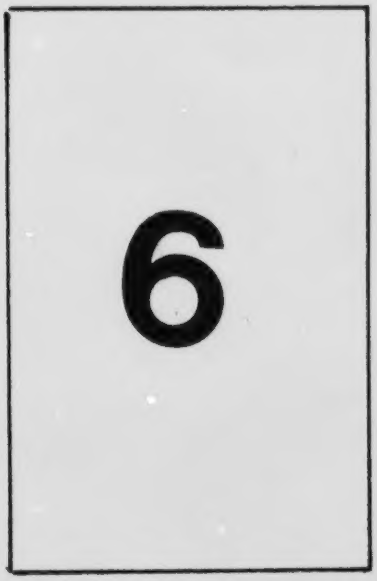
Activity: A set of objects is formed for all to see. Part of the objects are removed. The children are asked to show the minus symbol card. (For example, the Mathematics Instructional Paraprofessional forms a set of five blocks; then removes three blocks. The child will fix his "show-me-board" as in the following illustration:



Subtraction Concentration

Materials:	one set of 20 cards
Procedure:	Prepare 10 subtraction problems and 10 subtraction answers to match the problem.
Instructions:	Mathematics Instructional Paraprofessional shuffles the cards and places the cards face down on table. First player turns over two cards to see if he can make a match; if match is made he keeps the card and receives another turn. If the player is unable to make a match, cards are turned face down and next player takes his turn. Play continues until all cards are matched correctly. Player with most books is winner.





RED HOT SUBTRACTION

Activity: Red Hot Subtraction (3-4 players)

Skill: Subtraction

Objective: Given basic subtraction combinations, the students will name the difference.

Procedure:

1. Put some red hot candies in the center box.
2. The dealer mixes the two sets of cards and shuffle them. He deals five cards to each player and puts the rest on the game board for a draw pile.
3. The players check their cards for pairs containing a combination and its answer. Each player puts the pairs he has face up on the game board and takes one red hot from the box.
4. The players now take turns making matching pairs of cards.
5. The first player selects one of his numeral cards or answer cards and asks one of the other players for a matching card. "I have 6 - 2. Do you have a 4?" If he gets a card that completes a match, he puts the pair down and takes one red hot. If the player he asks does not have a matching card, he takes the top card from the draw pile. Again, if he makes a match he puts the cards down and takes one red hot. His turn is over after he completes his draw.

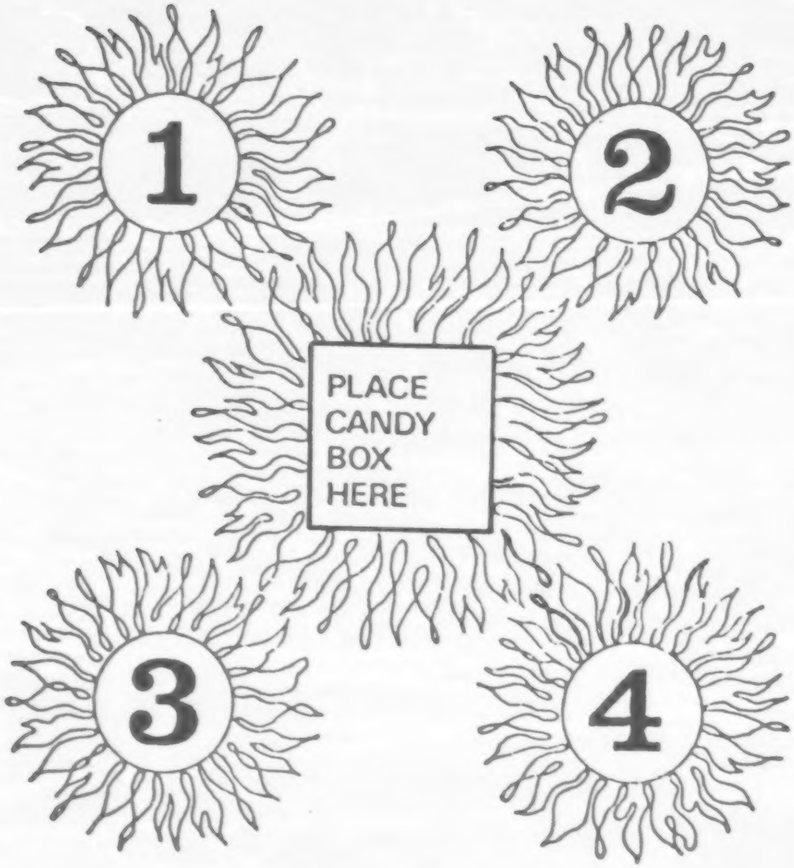
Variations: Use addition, multiplication, or division for the combination and answer cards.

Evaluation: Self-assessment - students use answer key

Materials:

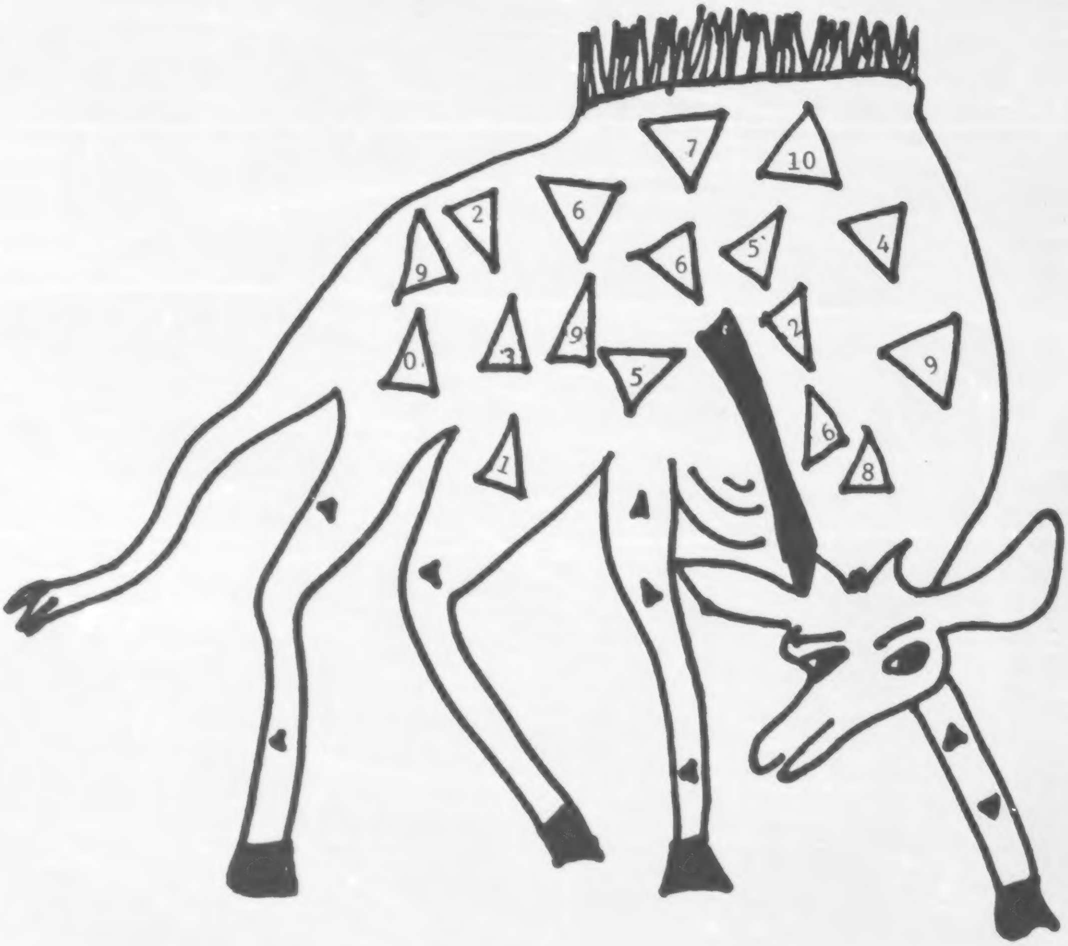
1. Make game board 22" x 22" (see diagram).
2. Small box in center of board for red hot candies.
3. Set of at least 20 subtraction combination cards on 3" x 5" cards.
4. Write combinations for the basic facts you want to practice during the game. Write the answer on another 3" x 5" cards.
5. Bag of red hot candies.
6. Key to check answers.

RED HOT SUBTRACTION GAME BOARD


1
2
PLACE
CANDY
BOX
HERE
3
4

GERALD GIRAFFE

Materials:	Gameboard for giraffe Subtraction fact cards 1 - 10 in triangle shapes Chips
Procedure:	Draw gameboard of Gerald Giraffe and make 17 subtraction fact card problems to correspond with answer on giraffe.
Instructions:	First player draws card; reads problem and matches it to the answer on gameboard. If answered incorrectly, card is returned to bottom of deck. Player earns a chip for each correct answer; winner is player with most chips.



SNEAKY SNAKE

Materials:

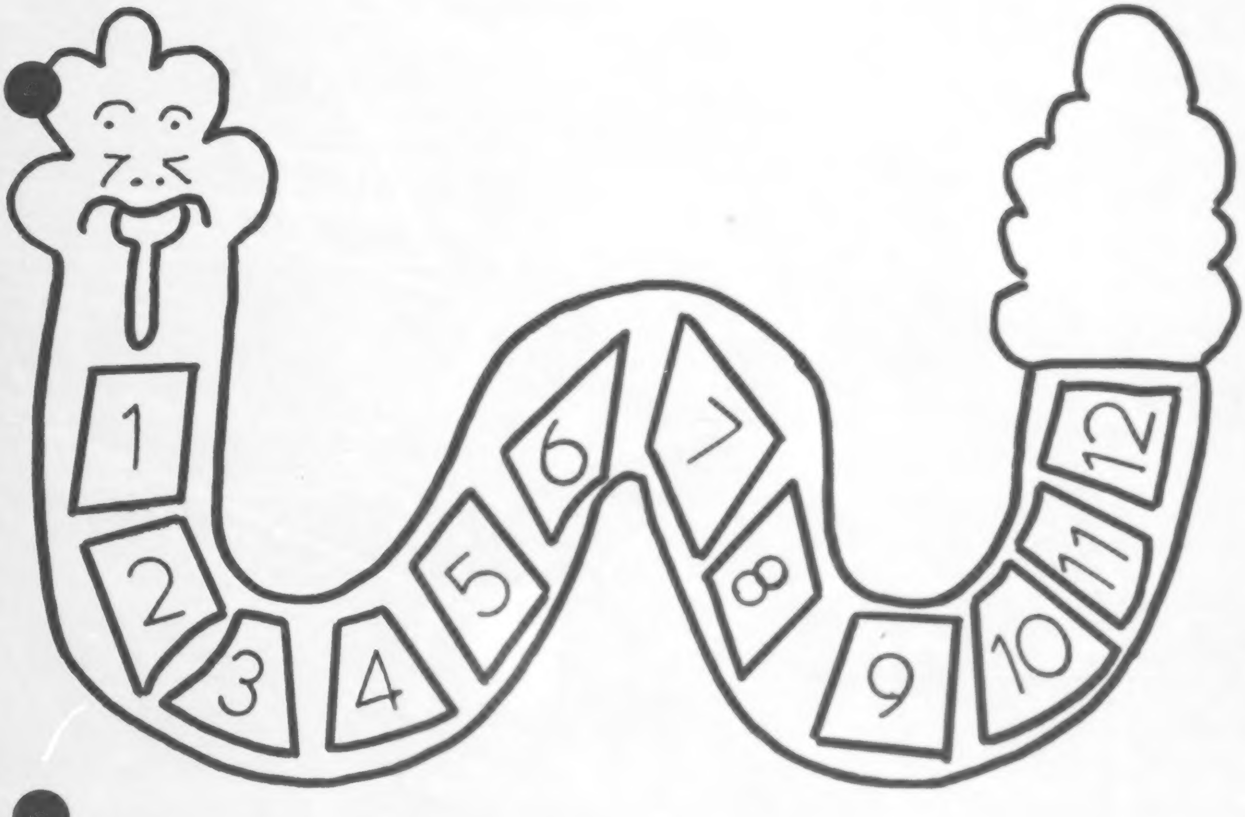
Pattern for snake
Four pieces of posterboard 8" x 10"
Magic markers
Counters
Two cubes number 1 - 6

Instruction:

Draw snake on each gameboard and write numerals 1 - 12 on snake. Write numerals 1 - 6 on each cube.

Directions:

First player rolls cubes and add the numbers or he may choose to subtract small number from large. He then covers the answer with a quiet counter. Play continues until all answers are covered. First player to cover all answers is winner.



ISLAND HOPPING GAME

Materials:

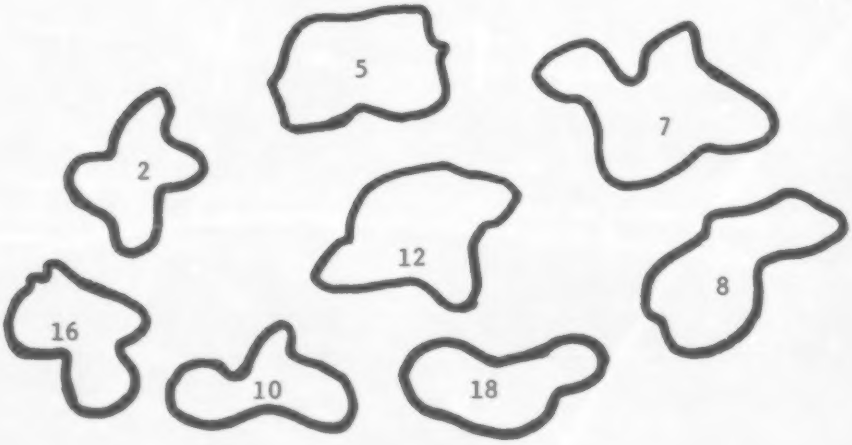
25" x 25" tagboard
three counting blocks
six characters
cardboard
tagboard

Procedure:

Nine or ten clusters of islands, similar to the one in the illustration, are drawn. These clusters are arranged in a circular pattern on the board. The faces of two of the counting cubes are marked with numerals. The faces of the third cube are marked with the symbols + and -. The islands are labeled with numerals that are the possible answers of the problems associated with a roll of the three cubes. The board can be decorated by drawing palm trees, and by painting the ocean blue and the islands green, etc.

Instructions:

1. Two to six students at a time are allowed to play "Island Hopping."
2. The object of the game is for the child to move his playing piece completely around the board, moving from one cluster of islands to another.
3. The child rolls the three cubes. The results in a number problem for him to solve.
4. The child finds the answer to this number problem. He looks at the first cluster of islands. If there is a numbered island that corresponds to this answer, he may move his playing piece to that island. If he cannot find an island in the cluster that corresponds to his answer, he cannot move his piece.
5. On the child's next turn, he throws the cubes and looks at the next cluster of islands to see if he can find an island for his answer. Play continues until someone moves his playing piece completely around the circle.



EYE GUESS

Materials:

1 - game board 22" x 28"
9 - 4" x 4" pieces of construction paper to serve as covers
9 - library pockets to hold answers
1 - deck of problem cards

Procedure:

Divide the game board into 9 squares. Place one library pocket with an answer card showing in each of the squares. Cover each pocket with one of the pieces of construction paper.
Mark the center cover Eye Guess. The rest of the covers are lettered A-H. See the illustration below.

Instructions:

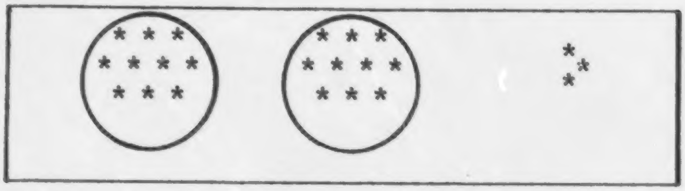
Lift the covers labeled A-H, exposing all the answers to the class. Do not expose the answer under Eye Guess. Return the covers over the answers. Expose a problem card to the student. The student must give the answer orally and he must indicate the position where it is hidden on the board. The correct answer and location gives that team 2 points. If the student does not think the answer to the problem has been exposed, he can say it is under the Eye Guess cover. If it is 1 point for his team. The team with the most points at the end of the contest is the winner.

9	10	17
12	15	13
16	11	14

A	B	C
D	Eye Guess	E
F	G	H

PLACE VALUE

Introduction



The above figure shows two groups of ten with three stars left over. The importance of place value is evident when one attempts to write a numeral for this number of stars. Instead of writing "two groups of ten and three more," one can simply write 23 and agree that the numeral in the "second place" (2 in this case) is to represent groups of ten.

In a place-value system with base ten, only ten symbols are needed to represent any number. This numeration system uses the digits 0 through 9.

While it is true that each of the digits, 0 through 9, indicates exactly one wholenumber when it stands alone, the very basis of our place-value system is that these digits may indicate many different numbers when used together. Thus, in the numeral 6,586,624 the first 6, starting from the left, indicates 6 million; the second 6 indicates 6 thousand; and the third 6 indicates 6 hundred.

At the heart of any place-value system is the agreement upon the type of grouping involved. The conventional grouping is by tens, which, it is theorized, may be related to the number of fingers on our two hands.

It is important to provide a careful development of the basic grouping and positional ideas involved in a place-value scheme. An understanding of these ideas is vital to future success (in gaining an insight into the relative size of large numbers and in computing).

Note: A firm understanding of the concept of place value is needed before a child is introduced to more than one digit addition, subtraction, multiplication and division problems. Stay with the concept until students have mastery.

cept: Place value

Equipment: Bundles of sticks, single sticks, rubber bands, place value boards

Activity: Children receive sticks, count them and using the rubber band, put them into sets of 10. When complete, children then count by 10's to see how many each have. Using the place value boards, children are directed to show numerals using bundles of ten and single sticks.

12" x 9"

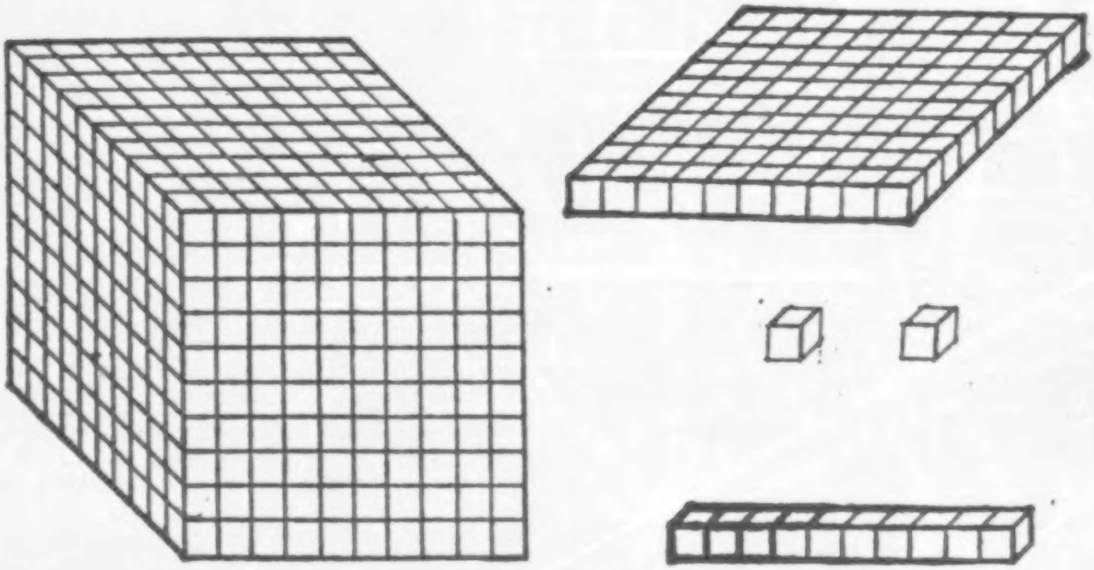
Tens	Ones

****

Concept: Place value

uipment: Stamp of Diennes blocks on tagboard - place value boards

Activity: Children show a designated amount of tens and ones using stamped cards on place value boards



Concept: Place Value

Equipment: Individual flannel board
Stamp of Diennes blocks

Activity: Children must show the appropriate numbers of tens and ones to correspond with a numeral selected from a hundreds chart or written on the chalkboard.

****

Concept: Place Value

Equipment: Place value board, two digit numeral cards for children.

Activity: Children show numerals as Mathematics Instructional Paraprofessional places bundles of tens and single sticks in place value chart - activity may be repeated using beans and bean sticks, etc.

****

Concept: Plave Value

Equipment: Overhead projector, bundles of ten toothpicks, plastic ring from canned pop, show me boards

Activity: Mathematics Instructional Paraprofessional places bundles and single toothpicks in rings on the overhead projector while the children put the appropriate numeral cards in their show me boards.

****

Concept: Place value

Equipment: Overhead projector, small transparencies of sets of ten and sets of one or dominoes made by punching holes in tagboard, chalkboards.

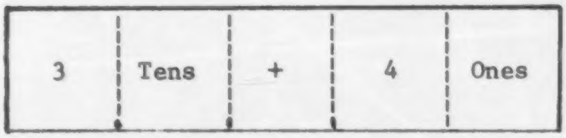
Activity: A two-digit number is either stated verbally or written on the board. A child is chosen to represent the number on the overhead using sets of ten and sets of one.

An alternate activity would be for the Mathematics Instructional Paraprofessional to place a number of sets of tens and sets of ones on the overhead. The children are asked to write the numeral representing the total number of dots on their chalkboards.

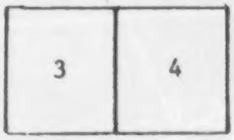
****

Concept: Place value

Equipment: Folding place value card

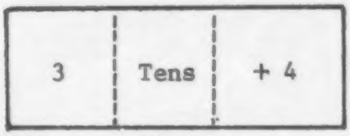


Completely Unfolded

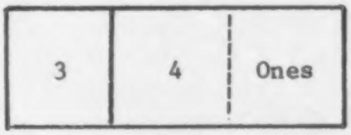


Folded

Activity: Begin with card completely folded, exposing only the two-digit numeral. Ask the children to identify the numeral. Ask the children to state the number of tens and ones that make up the numeral, then show them the correct answers by unfolding the card as shown below.



Tens



Ones

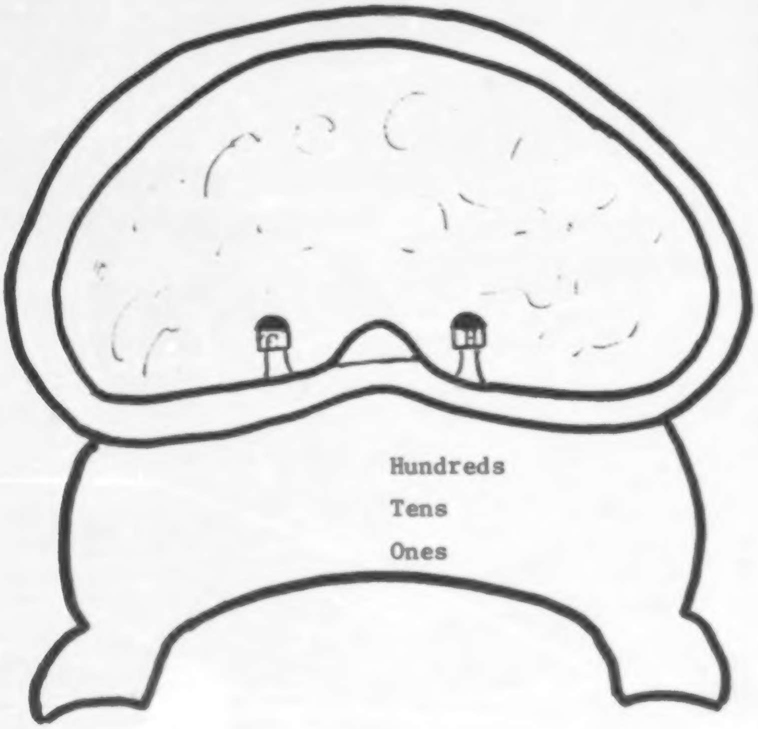
HOT WATER

Materials:

four bathtubs
ten each of the numbers 0-9 on bars of soap
chips

Procedure:

Each student has his own bathtub. Bars of soap are shuffled and first player draws a bar of soap, then places it in the hundreds, tens or ones. Play proceeds to next player. Object is to be the player to form the largest or smallest number, whatever the Mathematic Instructional Paraprofessional should decide. Winner of each round earns a chip. Winner is player with most chips.



SOAP
5

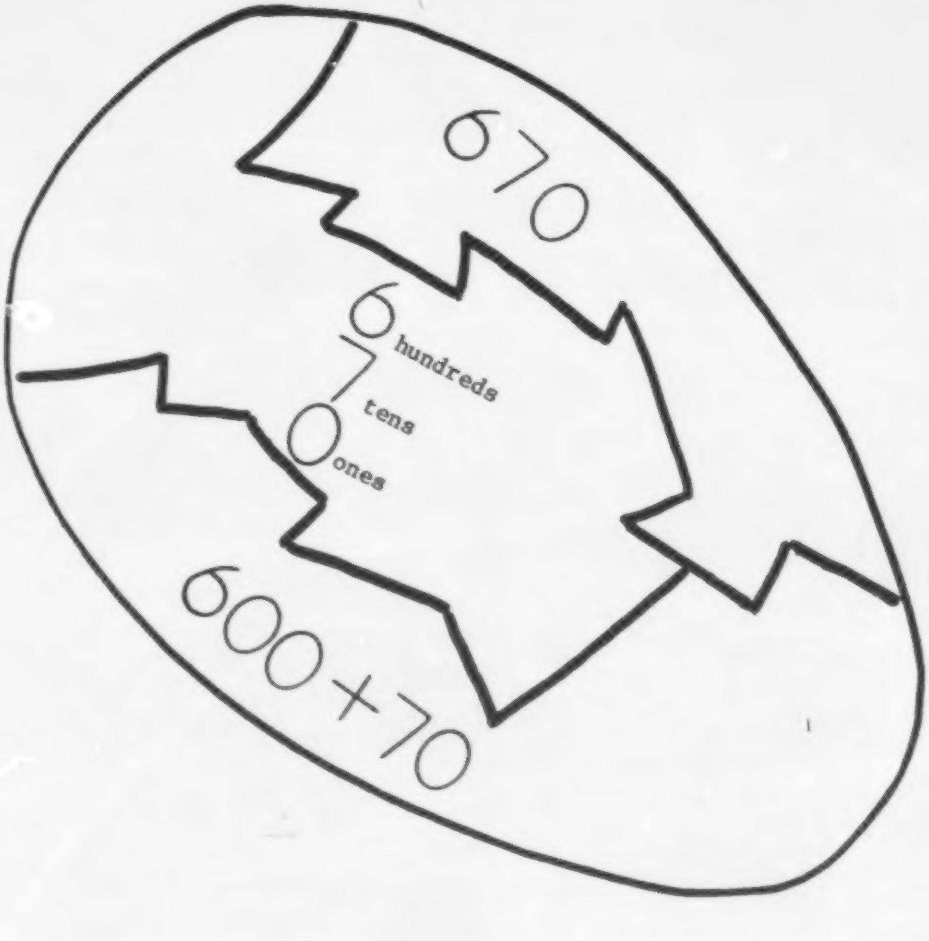
SOAP
2

SOAP
1

DINOSAUR EGGS

terials: Railroad board, approximately 60 cm by 50 cm

Procedure: On the railroad board draw 20 eggs similar to the one below. Write a three digit number, its expanded form, and its place value meaning on each of the eggs. Some suggested numbers are: 297, 308, 165, 272, 380, 444, 113, 221, 414, 132, 614, 421, 980, 879. 461, 462, 463, 471, 561, and 313. Cut the eggs into 3 sections, cutting each egg in a different way.

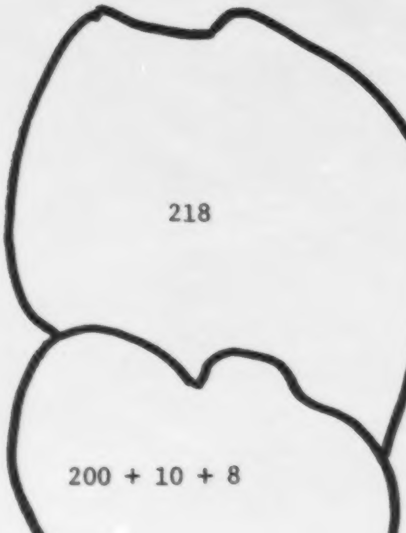


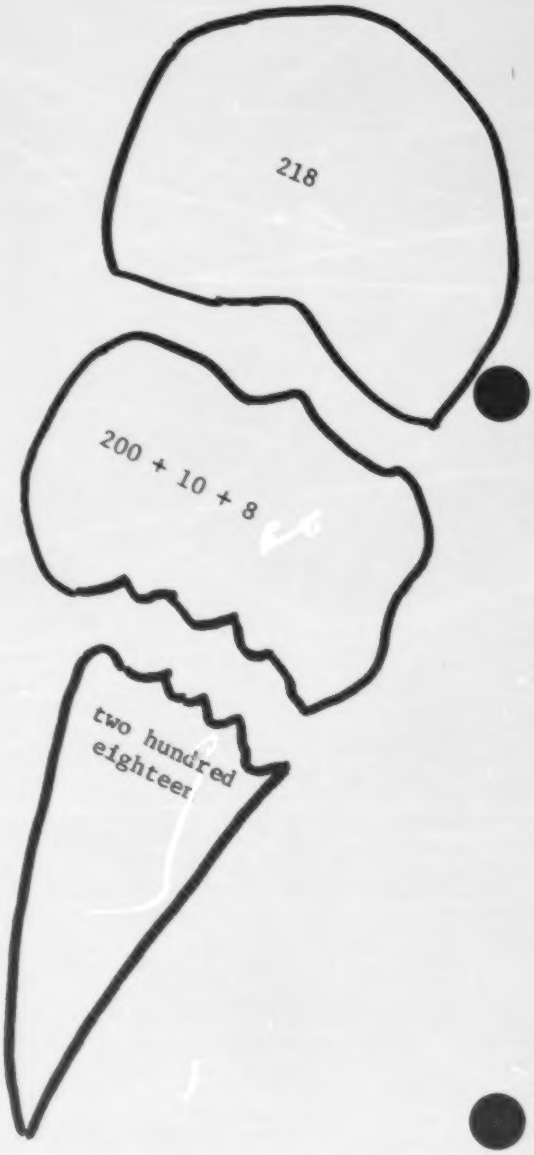
ICE CREAM CONES

Materials: Posterboard or cardstock 8 1/2" x 11"

Procedure: Draw and cut out ice cream cones (about 10" x 4") from posterboard or cardstock. Write numeral on one part, the expanded form of the numeral on another part and the numer word on the third part. Color the ice cream cones, laminate, and cut apart.

Directions: Students use the pieces to make complete cones whose parts match. This activity may be used on the magnetic board if magnets are placed on the back of the pieces.


218
200 + 10 + 8
two hundred eighteen


218
200 + 10 + 8
two hundred eighteen

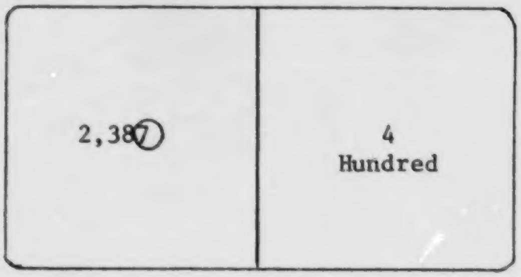
PLACE VALUE DOMINOES

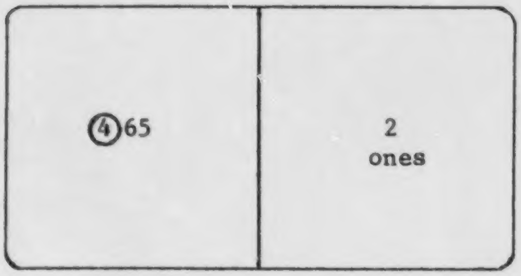
aterials: 28 - 2" x 4" cardboard pieces

Magic Markers

Procedure: Outline and divide each cardboard piece with a magic marker. On one-half of the cardboard write a three or four digit number. Circle one of the digit numbers with a black magic marker. Next write the place value of a number that has been circled on another piece of cardboard. Continue this procedure until all pieces have a matching dominoe.

Instruction: Deal out all dominoes to the players. First player starts by having two dominoes that match. He may play as many dominoes as he has matches for. Then the play goes to the next person. The child who gets rid of his dominoes first is the winner.



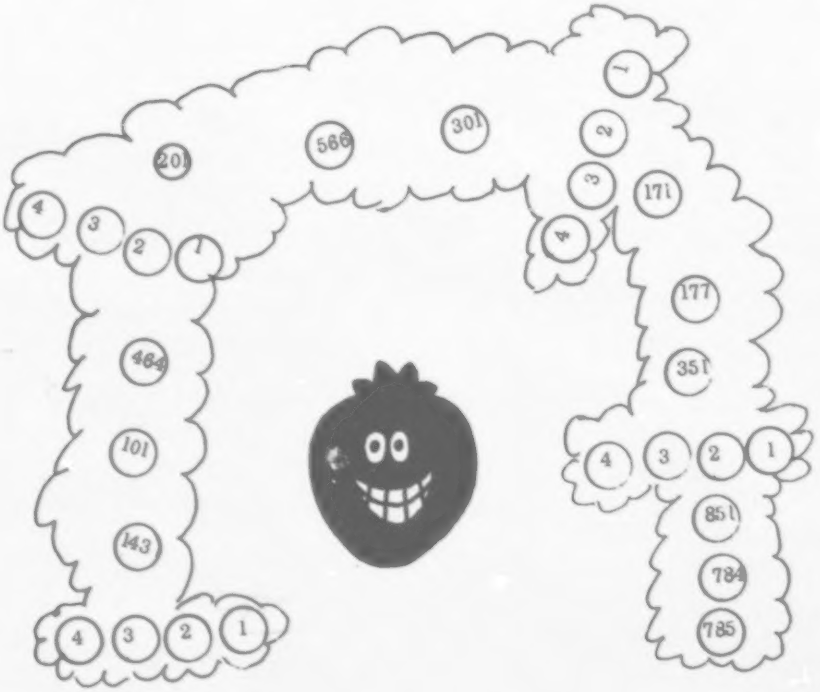


HULKS PLACE VALUE

Materials:
Gameboard
25 Diennes blocks stamped 100's cards
25 Diennes blocks stamped 10's cards
25 Diennes blocks stamped 1's cards
Movers
Cube numbered 1-6

Procedure: Draw gameboard as pictured and prepare cards as designated

Instructions: Decide on first player and have the player roll cube. He will receive that number of cards if he can make one of the numbers on the gameboard he moves up to number 4 and receives 4 chips; if not play passes to second player. Play will continue until all players move up to second round. Whatever number they land on is number of chips they receive. First player to land number 4 is last person to take turn on second round.



HUNT FOR DIGITS

Topic: Place Value

Grade Level: 3 - Up

Number of Players: 2 - 4

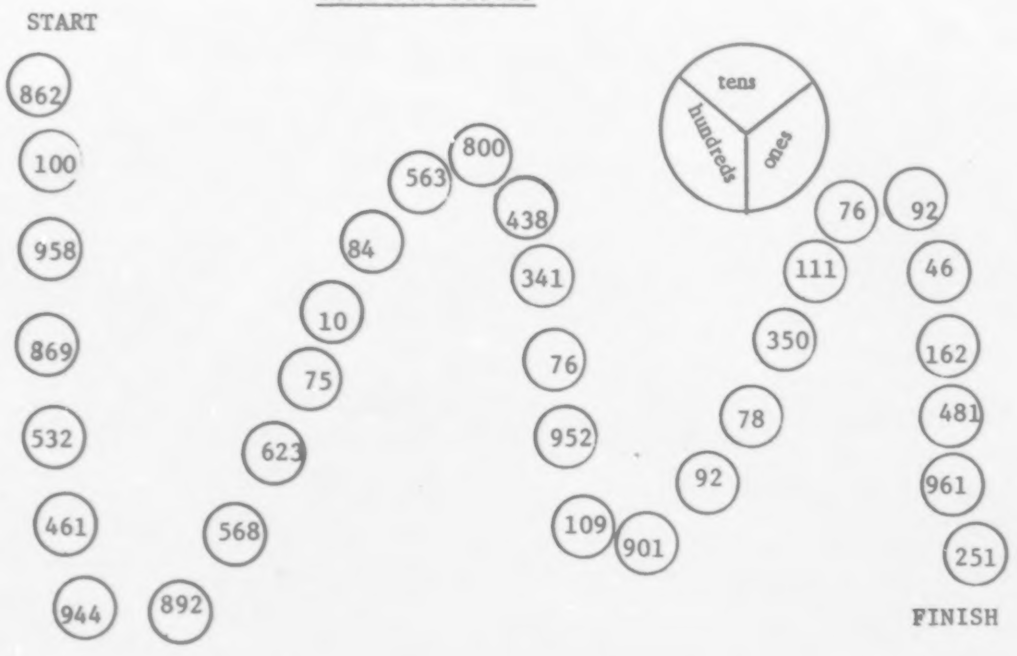
Materials: Gameboard - 40 cards - 4 each number 0-9 Movers

Object: To be first to reach last place

Directions:

1. Each player puts his marker at start. Player draws a card, then spins the spinner. The player moves to the space that has that number in the place shown by the arrow on the spinners.
2. If 2 players land on the same number, the second one will go back to start. Players shall move to the nearest space that has the number they are looking for even tho it may cause the player to go backwards.
3. Winner will be the player to reach the last space first.

HUNT FOR DIGITS

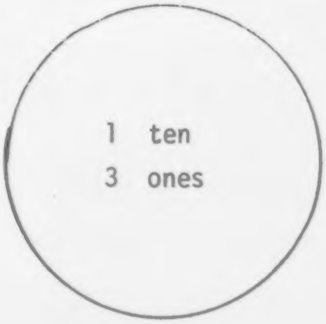

START
862
100
958
869
532
461
944
892
568
623
75
10
84
563
800
438
341
76
952
109
901
92
78
350
111
76
92
46
162
481
961
251
FINISH
tens
hundreds
ones

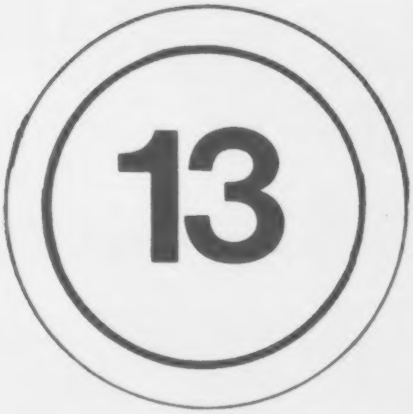
PLACE VALUE MATCH

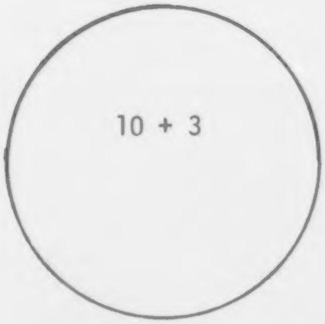
30 - cards

2 - players

Players take turns pulling from the deck. Each player puts the card face up on the numeral it matches on their side of the game board. If the numeral on the board is covered, the card is placed at the bottom of the pile and the next player pulls. The winner is the first to cover all answers or the one who has the most cards.







THE NUMBERS 100-999

To develop the concept of place value for the numbers 100-999, the Mathematics Instructional Paraprofessional must establish the grouping of hundreds, tens, and ones. When using sticks or toothpicks, put ten bundles of ten sticks together to represent a set of one hundred. When using the rectangular strips showing sets of ten dots, bundle ten rectangles together to represent one hundred. When using beans, glue ten bean sticks onto a sheet of tagboard to represent a set of one hundred beans, or bundle ten bean sticks together. When using money, use a dollar bill to represent one hundred.

An excellent commercial product that can be used to represent place value is a "Chip Trading Kit." This kit utilizes different groupings in the place-value system. (e.g., Red chip represents hundreds, green chip represents ten, yellow chip represents ones, etc. Therefore 3 red chips, 2 green chips and 4 yellow chips would represent the number 324.) You can make a kit similar to the "Chip Trading Kit" using different colored blocks, discs, pieces of wood, bottle caps, etc.

NOTE! To develop the concept of place value for three-digit numerals, use the activities described in the preceeding session. The only difference being the use of groups of 100 (sticks, toothpicks, dot cards, beans, money, etc.) to represent the three digit numerals.

ncept: Place value

Equipment: A set of ten cards labeled 0 - 9 for each team

Activities: You may want to organize the class into teams of two students to play the "greatest number" game. Two teams compete against each other. Each team has a set of the 0 - 9 cards in a paper bag. Each team takes a turn choosing at random a card at a time from the bag to build a (e.g. three digit numeral. The object of the game is to build a numeral that names the largest possible number number using the digits drawn. The result of each drawing is recorded in whatever position of a place-value chart the players choose. The card is then returned to the bag, all the cards are mixed and the next drawing is made by another team member.

TEAM A

	3	

TEAM B

9		

After six draws the team that has recorded its draw so as to name the larger number wins the game.

****

Concept: Place value - hundreds, tens and ones

Materials: Cubes with numerals 1 - 9 printed on them

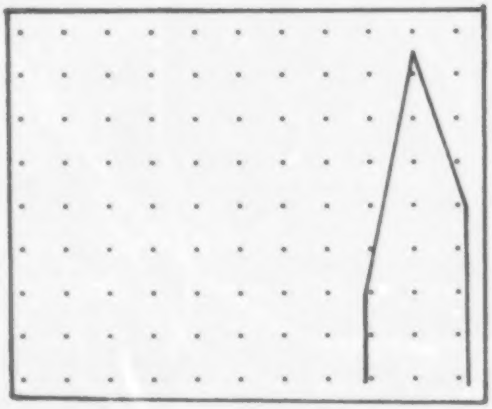
Activities: You may ask each student to roll two cubes and arrange them to make up the greatest number possible using the numerals as digits. Then ask him to rearrange them to make another numeral. A discussion might result as to how he knows which number is greater. Perhaps the students can come up with a rule for choosing the greater number.

****

ncept: Place value

Materials: Geo board

Activity: Mathematics Instructional Paraprofessional shall write a numeral on the board and the children shall use a rubber band to enclose the correct number of hundreds, tens, and ones. (e.g., 385)



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Concept: Expanded notation

Equipment: Individual chalkboards

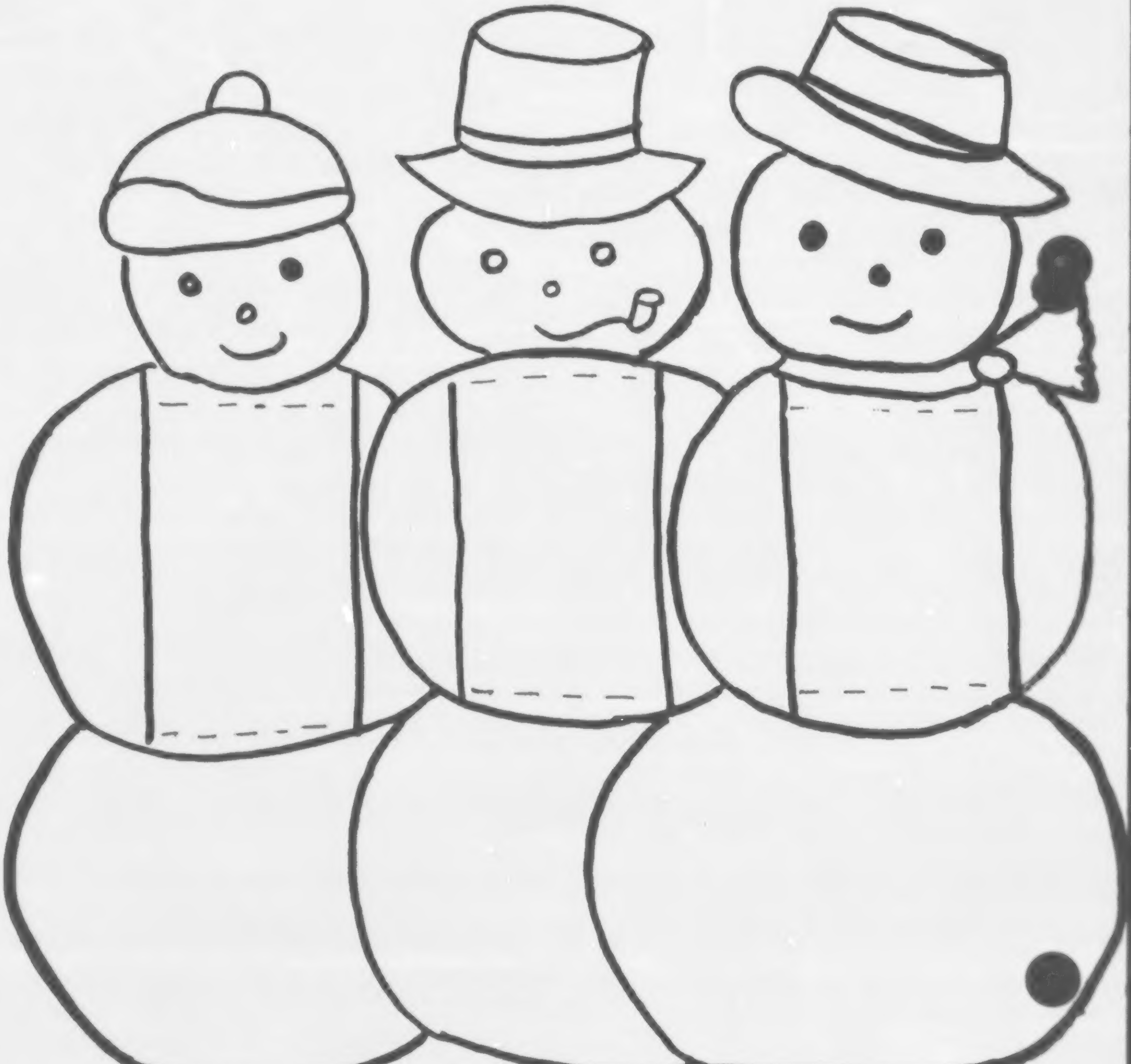
Activity: Being able to write a number in expanded notation will be very important when learning the concept of renaming and when developing the skill of long division.

Write a numeral on the chalkboard (e.g., 672). The students write the number in expanded notation on their chalkboards. They should write 600 + 70 + 2. Repeat with other numbers. To check for understanding, write the expanded form on the chalkboard and ask the students to write the correct number on their boards.

****

SNOWMEN

Materials:	one set of snowmen for each player magic markers scissors four strips of cardstock per snowman
Procedure:	Color in each snowman. Glue onto cardstock. Cut out the center part of the upper portion of the snowmen. Number the strips of cardstock 0 - 9 on each. Slip each strip into openings.
Instruction:	Teacher calls out a number: 7, 2, 1 - student will show this on their snowmen.

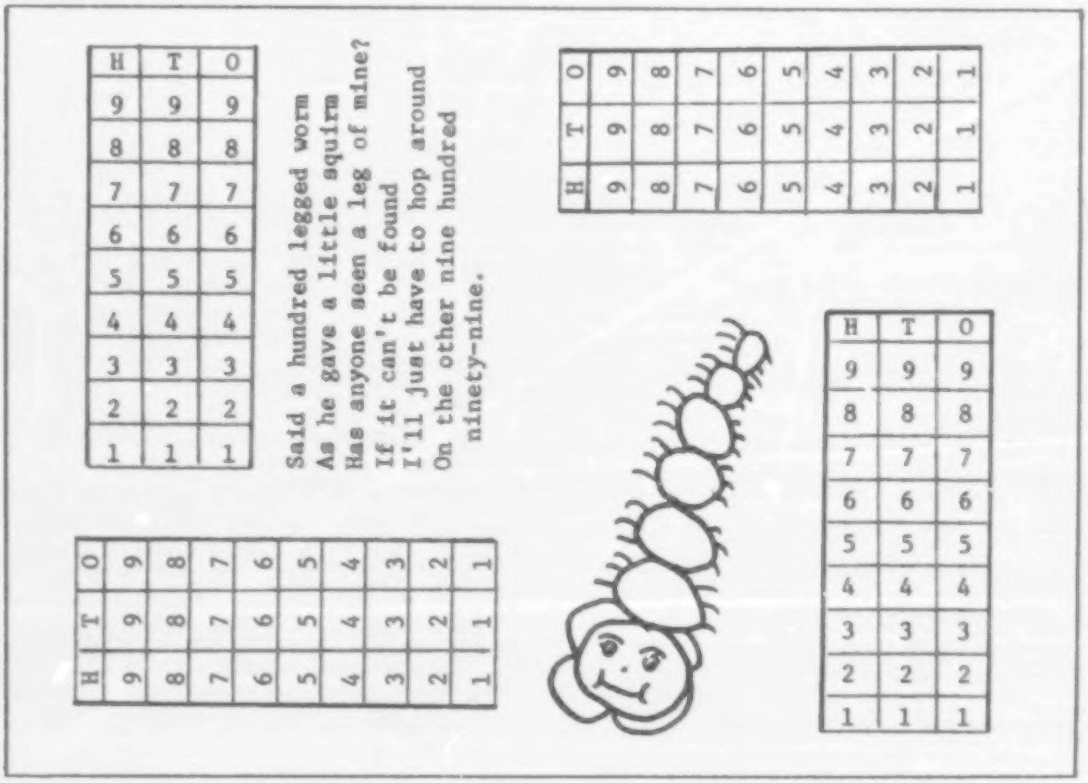


HUNDRED LEGGED WORM

Materials:	game board with spaces for four players three cubes - two marked 1-6 and one marked 4-9 each player needs three chips
Procedure:	Each player rolls a dice to see who starts first. Largest number starts and game continues clockwise.

First player rolls all three cubes, and arranges cubes to make the highest number possible, then places his chips on those numbers on the game board. Each player does the same. As each players turn comes up they roll the three cubes and arrange them so they keep moving up the columns toward the nines - hundreds, tens and ones in that order. A player never moves down and does not necessarily have to move all three chips at one time. After he's formed his number with the cubes, he may end up moving only one or two chips. The number of chips he gets to move in any turn depends on the number they have formed with the three cubes. The player who gets his chips on the three nines across the top first is the winner.

Always make them read the numbers they have formed, even if they can't move any chips.



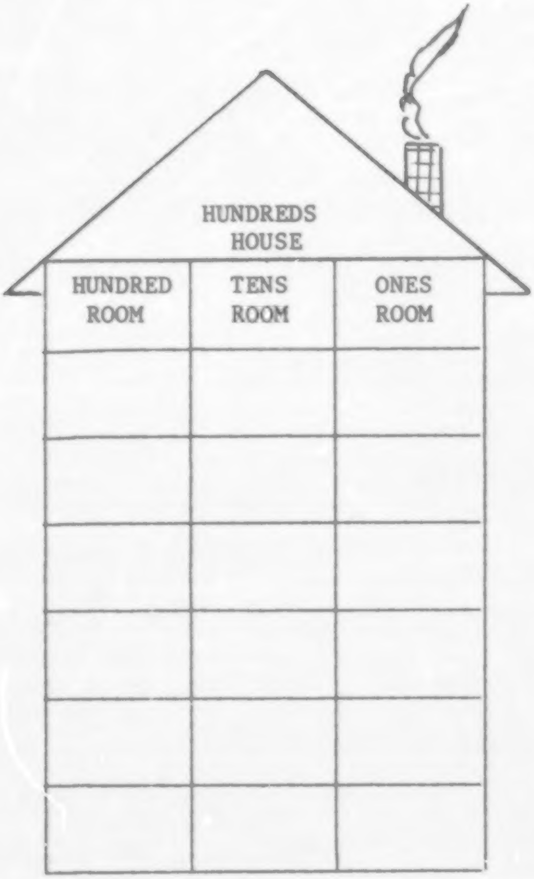
Said a hundred legged worm
As he gave a little squirm
Has anyone seen a leg of mine?
If it can't be found
I'll just have to hop around
On the other nine hundred
ninety-nine.

HUNDREDS HOUSE

Materials:
four gameboards
four Overhead Projector pens
two sets of cards numbered 0-9
chips

Procedure: Prepare four hundreds house boards and laminate. Prepare the sets of cards.

Instructions: First player draws card and writes in on the first row in the hundreds, tens or ones column. Proceed until all places have been filled in the hundreds, tens and ones on first row. Winner is person that made the largest number. This player wins the chip. Continue until all floors have been filled.



SAY THE NUMBER

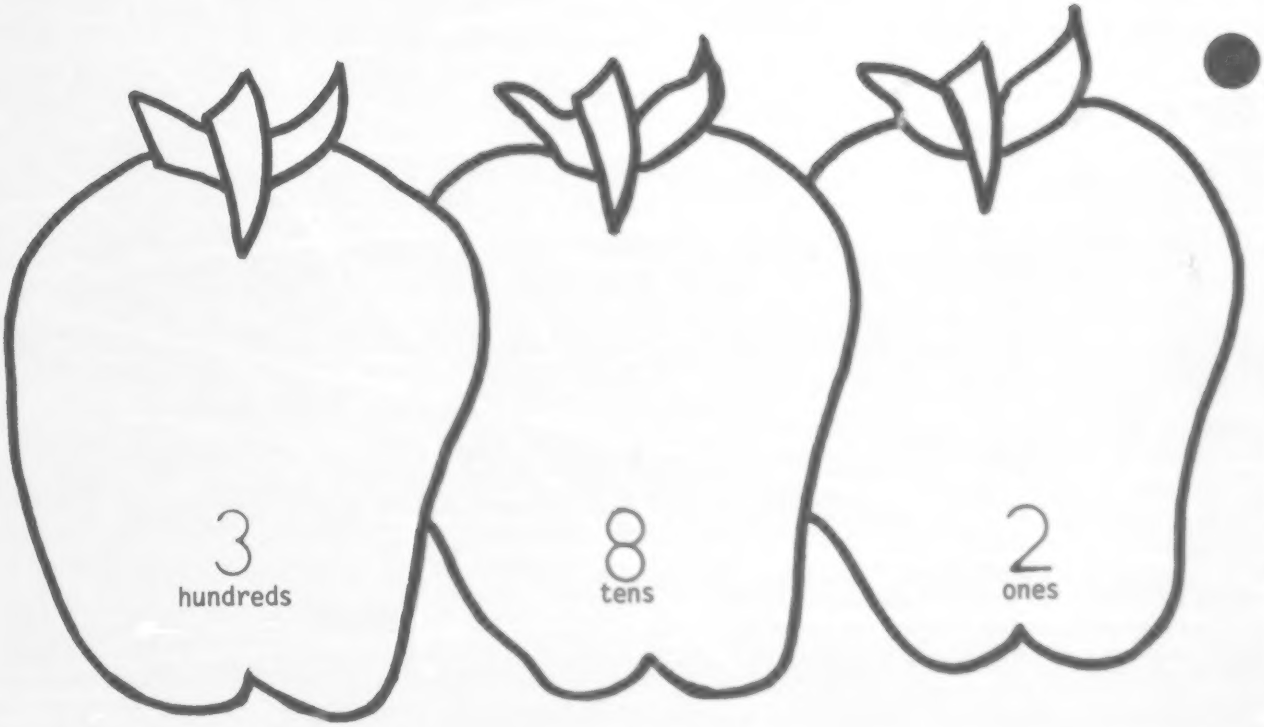
Materials:	three cubes chips magic slate
Procedure:	Number 1 cube marked 1 - 6, 1 cube marked 4 - 9, 1 cube marked 2 - 7
Instructions:	Decide on first player; have player roll all three cubes and form the largest number possible. Have the player write the number on his slate. Proceed until all students have had a turn. Player that has largest number earns a chip. Winner is person with most chips at end of time period.

PLACE VALUE APPLES

Materials: tagboard cut into 36 apples
colored markers

Procedure: Cut 36 apples from tagboard. Using the colored markers number the apples from zero to nine, making four cards which show each number. Write "ones", "tens" or "hundreds" on each of the four sets.

Instructions: Shuffle the apples and give each student nine cards. Mathematics Instructional Paraprofessional shall call out a number (e.g. 382) the student show their apples.



REGROUPING

Introduction

Regrouping, often called in traditional arithmetic program "carrying" and "borrowing," has been historically a very difficult process to master. Note the word process in the preceeding sentence; it has been the traditional approach to regrouping as a process rather than a concept which has presented the difficulty. In the contemporary mathematics program, regrouping is presented as a concept first and a process second. It is a very fundamental aspect of the overall structure of mathematics and should be afforded recognition as such. (Many of the problems that children have in multiplication and division, once they get past the basic facts, stem from a lack of mastery of the concept of regrouping rather than a deficiency in multiplication or division.)

The children should be given extensive practice in analyzing the regrouping concept as they progress to the standard algorism applying their understanding to the process. For example, they find the sum of 48 and 23 as follows:

A.

$$\begin{array}{rl} 48 & = 40 + 8 \\ + \underline{23} & = \underline{20 + 3} \\ & = 60 + 11 \\ & = 60 + (10 + 1) \\ & = (60 + 10) + 1 \\ & = 70 + 1 \\ & = 71 \end{array}$$

B.

$$\begin{array}{rl} 48 & = 40 + 8 \\ \underline{+23} & = \underline{20 + 3} \\ & = 60 + 11 = 70 + 1 = 71 \end{array}$$

C.

$$\begin{array}{r} 48 \\ \underline{+23} \\ 71 \end{array}$$

As is the case with most mathematical concepts and processes, regrouping is best understood through the use of concrete materials. Consequently, the concept of regrouping is introduced with manipulative materials. Some possible materials are listed below:

- popsicle sticks
- pop lids (pepsi, 7-up, coke, etc.)
- poker chips
- toothpicks
- coffee stirrers
- gum wrappers (white - spearmint; green - doublemint; yellow - juicy fruit)
- beansticks

NOTE: This concept is critical for success in computation. Stay with the concept until your students have a thorough understanding of it.

Concept: Regrouping (renaming)

Equipment: Toothpicks, popsicle sticks, coffee stirrers

Activity 1:

One way to start the session is by holding up a bundle of ten and asking the students how many there are in the bundle. With the emphasis on place value in textbooks, most students answer ten; if not the sticks may be unbundled and counted. The same procedure is used for introducing the idea that the next larger size is made of ten groups of ten (hundreds).

Several different combinations of bundles, such as 6 tens 2 ones, may be used to help the students learn to recognize the quantity of sticks. A music stand or the chalk tray can be used to hold the different combinations of bundles so they can be more easily seen than when they are placed on the table. A possible sequence of combinations of bundles to follow is:

1. 2 tens 3 ones
2. 4 tens 1 one
3. 3 tens 11 ones
4. 5 tens 2 ones
5. 4 tens 12 ones

Problems 3 is introduced to help the student formulate the idea that a quantity can be expressed different ways and definitely should follow example 2. It is suggested to follow problems 3 with 2 tens 21 ones etc. and record the pattern on the chalk board. This concept of being able to represent a quantity different ways is important in understanding the four basic operations of whole numbers. For example, consider the subtraction example $\begin{array}{r}32\\ \underline{-\ 9}\end{array}$. The decomposition of 32 into $\overset{2}{\cancel{3}}\,12$ is the same as expressing 3 tens 2 ones as 2 tens 12 ones. (Regrouping)

****

Concept: Regrouping (renaming)

Equipment: Toothpicks, popsicle sticks, coffee stirrers

Hand out bundles of tens and single sticks to the students. Give your students a large number of single sticks (e.g., 36) and ask them what the maximum number of bundles of tens that could be formed with these sticks. If they don't know the answer, have them bundle the sticks into tens. Repeat with other groups of single sticks.

A next logical step is to have the students represent the same quantity (3 tens, 6 ones) with different groupings such as 2 tens, 16 ones. The students using the sticks will find different representations for this one quantity. Only examples of two digit numbers should be used.

These important ideas of positional notation and regrouping can be further emphasized by listing the findings of the students. The example, 3 tens, 6 ones, should be placed on the chalkboard and the different groupings as formed by the students should be recorded. For example,

$$\left.\begin{array}{l}\text{3 tens, 6 ones}\\ \text{2 tens, 16 ones}\\ \text{1 ten, 26 ones}\\ \text{0 tens, 36 ones}\end{array}\right\}\quad\text{Regroupings}$$

It might be asked at this time, "If a student has 36 sticks, what is the most number of ones that can be formed?" These questions should be asked after each example until the students understand the concept. Several more examples similar to 3 tens, 6 ones should be presented where the above procedure is followed, that is, recording the results of the students on the board.

****

Draw for One Hundred

Materials:

- set of about 28 tiles or chips, 14 each of the numerals 1 and 10
- one playing board for each player (see pattern)
- score sheets

Players: 2 to 5

Directions: Place tiles face down on table.

Each player in turn

- draw 5 tiles.
- place tiles on playing board.
- read aloud the total value of the tiles.
- record that total on score sheet.
- return tiles, face down, to set of tiles on table and "mix" them up a bit.

Each time a player has a turn, repeat procedure and add that total to previous total earned by that player.

Winner is the first person to reach a total of 100 or more.

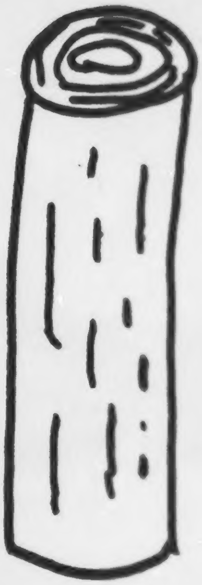
Draw for One Hundred

tens	ones

ALLIGATOR BIT IT

Materials: Make a pellon gameboard 20" x 20" of a pond of water. Make 20 logs with subtraction problems on bottom of log with and without regrouping. Draw 20 alligators to go with logs.

Procedure: Lay all logs on pond; problem side down. Place alligators on top of logs. Have students work problems; if answered correctly they will keep alligators if not they give the alligator to the Mathematics Instructional Paraprofessional. Play continues until all problems have been answered.



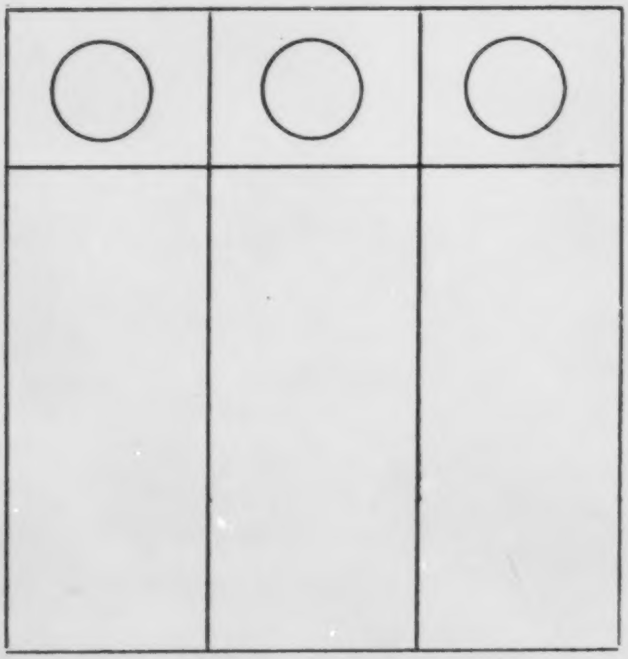
TRADING ACTIVITIES

Materials: Manipulative materials such as chips, counters, bottle lids, beads, straws, etc.
Individual boards for each participant, Number Cubes (cubes with numerals on their faces)

Procedure: Color code the manipulative materials using 3 different colors, (Red - Green - Yellow)
Make 3 columns on individual boards and designate the ones column, RED, the tens column, GREEN, hundreds column, YELLOW.

Instructions: Addition Concept - One cube is rolled. A set of red objects equal to the numeral shown is formed under the ones column on the board. Continue rolling the cube and have the children trade 10 red objects for 1 green object when they have 10 or more red objects. First student to get a yellow object wins the game.

Subtraction Concept - Each pupil places a yellow object in the hundreds column. Cube is rolled (Example: 6, the yellow object is traded for 10 green objects. 1 green object is traded for 10 red objects. 6 red objects are removed). The child continues to roll the number cube, subtracting the number of objects from his board as shown on the cube. The first student to subtract all his objects from his board wins the game.



RENAMING BINGO

terials: 4 20 cm x 20 cm pieces of pellon or poster board

1 deck of cards

Procedure: Construct a Renaming Bingo game board for each participant similar to the illustration below.
Mark the cards with numbers that have been regrouped -
e.g. 1 ten and 17 ones, 6 tens and 18 ones,
3 tens etc. Limit your number to those
between 20 and 70

Directions: Have the students select their own numbers for their card. Let them choose any numbers between 20 and 29 for the first column, and number between 30 and 39 for the second column, and any number between 40 and 49 for the third column, any number between 50 and 59 for the fourth column, and any number between 60 and 69 for the fifth column.

After the students have recorded their selections, cards are drawn and numbers are called in the form of 1 ten, 12 ones; 3 tens, 17 ones, etc. Give each student counters to cover the numbers called that they have on their boards. The first student to cover five in a row is the winner. This game can be adapted for numbers in the hundreds.

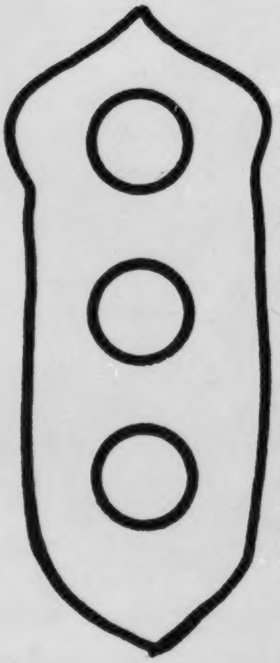
		FREE		

RED LIGHT - GREEN LIGHT

Materials: Approximately 40 cards - size 3 x 5
Red, yellow, green magic markers
Pattern for stop light

Procedure: Place regrouping problems on the cards--decorate with stop light pattern. Make pair of cards, i.e.:

STOP--Ones to Tens (+)		STOP--Tens to Ones (-)	
321 +329	239 +643	876 -547	768 -249
STOP--Tens to Hundreds (+)		STOP--Hundreds to Tens (-)	
565 +254	374 +374	659 +461	868 +187
STOP--Ones, Tens, Hundreds (+)		STOP--Ones, Tens, Hundreds (-)	
476 +386	247 +195	524 -295	425 -196
GO (+)		(GO) (-)	
456 +543	271 +526	884 -563	472 -331



(On the back of the cards--key the operation and the type of regrouping if any, that is needed as the example shows below.)

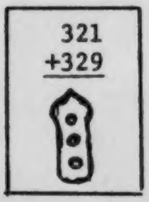
PLAYING INSTRUCTIONS FOR RED LIGHT - GREEN LIGHT

Cards are stacked in the center of the playing area. Each pupil in turn takes a card face up. He lays the card in front of him. Play continues until someone sees a pair that match in operation AND in the type of regrouping required. He books the two cards and says RED LIGHT if it is a regrouping problem; GREEN LIGHT if it does not require regrouping. He must ALSO state the operation and the type of regrouping required. (in green light--only the operation is necessary)

The winner is the person at the end of the game who has correctly "booked the most cards.

Players may challenge a "book" by looking at the key on the back. Any cards that do not match are put back at the bottom of the deck.

Face Up →



Stop +

ones--
tens

← Back-
Keyed

REGROUPING BOARD

Materials:

1 sheet poster board -- size 28" x 22"
13 library pockets
31 red cards - size 3 x 5
32 orange cards - size 3 x 5
32 green cards - size 3 x 5
31 brown cards - size 3 x 5
1 blue card - size 3 x 5

Procedure:

Mark vertical lines 7 inches apart
Mark horizontal lines approximately 2 inches down for the first and then one single line 6½ inches down, and finally, a double line 6½ inches down.

Mark 3 decks of red cards - using digits 0-9. Add one that has TEN HUNDRED'S on it.

Mark 3 decks of orange cards -- using digits 0-9. Add one card that has TEN TEN'S. Add another card that has ONE THOUSAND on it.

Mark 3 decks of green cards -- using digits 0-9. Add one card that has TEN ONE'S. Add another card that has ONE HUNDRED on it.

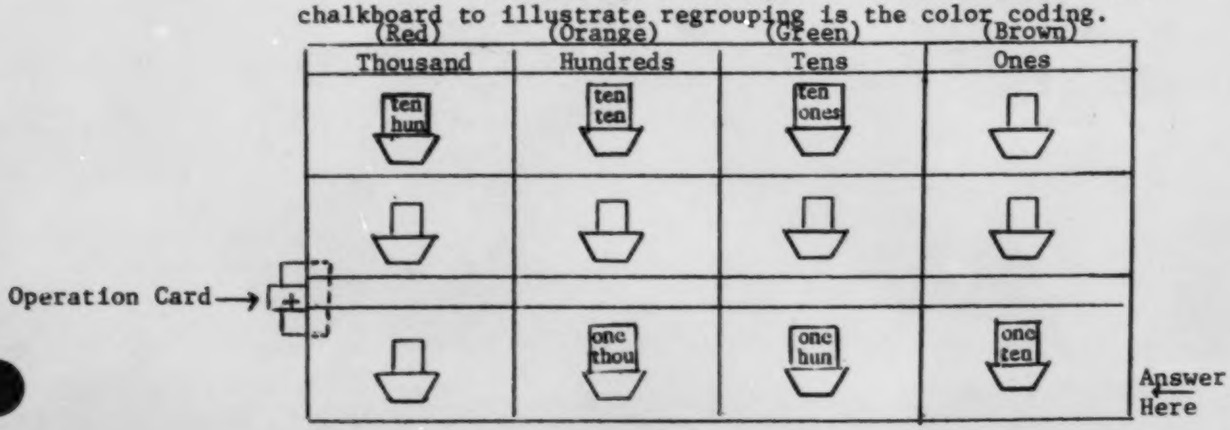
Mark 3 decks of brown cards -- using digits 0-9. Add one card that has ONE TEN on it.

Glue one library pocket on the back of the poster board as shown below and write a plus sign on one side of the blue card and a minus sign on the other side. This will be your operation card.

Glue remaining 12 library pockets on as shown below and insert the decks according to color code as outlined.

Instructions:

Used for showing regrouping problems in addition and subtraction. The advantage of using this board instead of the chalkboard to illustrate regrouping is the color coding.



ADDITION OF WHOLE NUMBERS

MISSING ADDEND

Introduction

The study of missing addends is an important step toward the solution of subtraction problems. All subtraction problems can be written as missing addend problems. (e.g., $9 - 4 = \boxed{}$ could be written as $4 + \boxed{} = 9$.)

SUM OF THREE ADDENDS

When working with a problem involving the sum of three addends, the child should remember two important concepts: (1) He can add only two numbers at a time. (2) To add more than two numbers, the addends must be grouped. He may group addends any way he wished without affecting the sum (e.g., $2 + (3 + 4) = (2 + 3) + 4$). This second concept is called the associative property of addition. When students are working problems involving the sum of three addends, the Mathematics Instructional Paraprofessional must allow them ample opportunity to discover that the sum is the same, regardless of the way the addends are grouped.

TWO AND THREE DIGIT ADDITION

After a child has mastered the basic addition facts, has an understanding of place value, and has an understanding of regrouping, he should be able to add any two whole numbers.

WORDED PROBLEMS

There are plenty of good worded problems in our adopted text. If you make up worded problems, make them as realistic to the student as possible - the kind of problems the student might encounter.

Concept: Missing addend

Equipment: Rings and things

Activity: Give each child some blocks--not to exceed ten. Give him also a ring made from tagboard. Have children put a given number of blocks on the left of the ring. "Put two blocks on the left side of your empty ring." Then tell them to add enough more inside the ring to make a certain number altogether. "Add enough more to make seven altogether." The children would then put five blocks into the ring and give the appropriate number sentence or explanation. The Mathematics Instructional Paraprofessional should be demonstrating the same problem on the magnetic or chalkboard and at the same time asking leading questions such as, "How many did you add? How many do you add to two to get seven? Two and how many more make seven?"

****

Equipment: Magnetic board

Activity: Characters are placed on magnetic board for all to see. Mathematics Instructional Paraprofessional shields some of the objects and children verbalize as to missing addend.

Repeat above activity using overhead projector and coins, counters, etc.

****

Concept: Missing addend

Equipment: Individual chalkboards

Activity: A frame problem involving a missing addend is written on the chalkboard (e.g., $\boxed{} + 6 = 8$ or $3 + \boxed{} = 7$). The children are asked to write the problem on their chalkboards and then find the number for the frame that will make the sentence true. The children then hold their chalkboards in the air for the Mathematics Instructional Paraprofessional observation.

****

Concept: Three addends

Equipment: Blocks, rings - make three sets

Activity: Children use blocks and rings to make three sets and verbalize number sentence for the sets. To find the sum, children combine the first two sets and add the third set to the sum of the first two.

****

Concept: Three addends

Equipment: Magnetic board

Activity: Using magnetic characters, a child separates a set into three subsets on the magnetic board. The other children state the cardinal number for each subset as the Mathematics Instructional Paraprofessional writes it. The Mathematics Instructional Paraprofessional then puts parenthesis around the first two subsets and the children verbalize the complete number statement. The parentheses are then transferred to the other sub sets. Children verbalize the process.

****

Concepts: Three addends

Equipment: Individual chalkboards

Activity: The Mathematics Instructional Paraprofessional writes a number on the board (e.g., eight). The children are asked to use three numbers in an addition problem. (These numbers must add up to the number on the board.) Some possible answers for the above example are: 2 + 2 + 4 = 8, 6 + 1 + 1 = 8, 3 + 3 + 2 = 8, etc. The different answers are written on the board. The beginning number is then changed and the activity is repeated.

CONCEPT: 2 two-digit addition

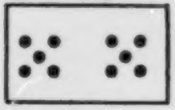
pment: Counting sticks, boxes labeled tens and ones

Activity: Several bundles of ten sticks are made. An addition problem involving 2 two-digit numbers is written on the board. A child comes forward and represents each number by placing one bundle of ten sticks for each ten in the "tens" box and enough single sticks in the "ones" box to represent the ones. Two "tens" and two "ones" boxes are used. To find the sum, the bundles of tens sticks and the number of ones are combined. If the number of ones is greater than ten when they are combined, another bundle of ten is made by taking ten of these ones. This demonstrates the concept of regrouping.

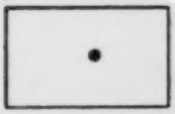
****

CONCEPT: 2 two-digit additon

Equipment: Individual flannel boards, rectangular pieces of construction paper showing sets of ten dots



, rectangular pieces of construction paper showing sets of one dot



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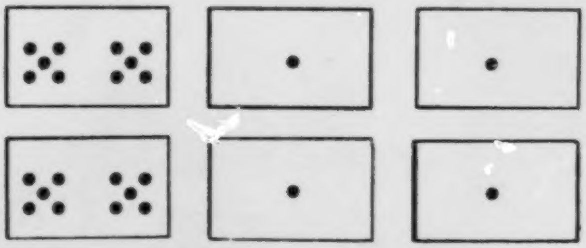
Activity: An addition problem involving 2 two-digit numbers is written on the chalkboard. The children can represent each number by using the pieces of construction paper showing sets of ten and one. For example, the number 24 would be as follows on their flannel boards:



The sum is found by joining the "tens" pieces and the "ones" pieces. If there are more than ten pieces showing one element, the ten pieces showing one element should be traded for one piece showing ten elements. This is the process of regrouping.

99

Materials:
1 deck of cards
4 each of 1-10
4 each of 2 different symbols
4-99 cards
10 chips for each player

Procedure: Object of the game is to get a total of 99 and force a player not to be able to play a card.

Instructions:

1. Deal 3 cards to each player.
2. Put remaining cards face down in center of table.
3. Each player receives 10 chips.
4. Player to left of dealer begins play.
5. Players keep a running total of cards played.
6. Special cards are used as follows:

    4 - Reverses play
    10 - Subtract 10 from total
    9 - Keeps score the same
    99 - Automatically makes score 99 (4-9 or 10 will be only cards that can be played!)

7. Player who is unable to play a card loses and must give each player a chip.
8. Player with most chips is the winner.

Concept: 2 two-digit addition

Equipment: Individual chalkboards

Activity: A problem showing the addition of 2 two-digit numbers is written on the chalkboard. The children copy the problem on their chalkboards and compute the answer. When they are finished they must hold their boards in the air for the Mathematics Instructional Paraprofessional's observation. More interest can be created by having a contest to see who can finish first.

****

Concept: 2 three-digit addition

Equipment: Individual chalkboards.

Activity: The Mathematics Instructional Paraprofessional either writes on the chalkboard, or verbalizes, an addition problem involving 2 three-digit numbers. The children copy the problem on their chalkboards and find the sum. When they have finished they should hold their chalkboards in the air for the Mathematics Instructional Paraprofessional's observation. (It is important to use numbers that do not involve regrouping when the children are finding the sum.

****

BUG YA

Materials:

2 - cubes
container (box, can etc.)
scratch paper for scoring

Procedure:

Put a bug on one side of each cube. (Hallmark makes a cute bug sticker.) Put numerals 2 and 5 on opposite sides, put 3 and 4 on opposite sides, put 1 opposite the bug. (Note: you will have to use larger numerals for the larger addition facts.

Instructions:

Each child takes turns rolling his set of cubes. He keeps a running score of his total.

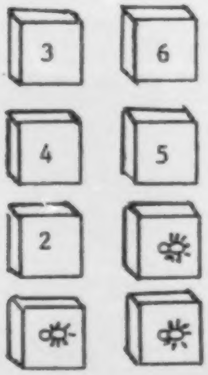
If one bug comes up, child subtracts the number from the total score.

If both bugs appear, child loses total score.

Use 2 cubes for each couple playing.

First child to reach 100 is winner.

Example:



add 9

add 9

(subtract 2)

(lose total score)

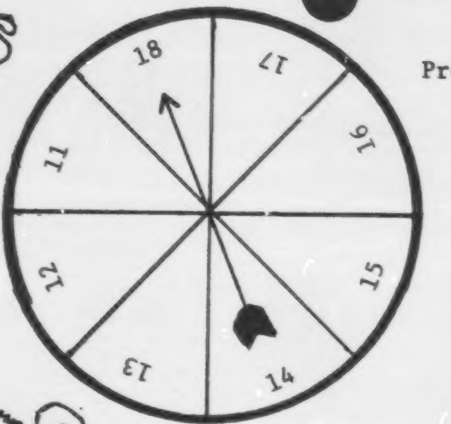
SCORE

$$\begin{array}{r} 9 \\ \underline{+9} \\ 18 \\ \underline{-2} \\ 16 \\ \underline{-16} \\ 0 \end{array}$$

Concepts: Reinforce addition and subtraction. (Can be used for multiplication by multiplying cubes instead of adding. Subtract as above).

The small child can play this by keeping track of his score with quiet counters. After 3 times around, each child counts the number of counters he has. The one with the most is the winner.

PINK PANTHER'S SEARCH FOR ADDENDS



Equipment: Gameboard with spinner (11 to 18)
Counter (different color for each player

Procedure: Each player spins in turn, finds 2 addends that equal the number on spinner and covers them. Numbers must touch on sides or corners. Players may not cover numbers if a wrong combination is stated or if there are no more combinations that add up to the number on the spinner. Winner is player with the most counters when board is full or time is up.

9	2	8	5	6	7	8	7	7	8
3	5	8	4	7	4	9	6	8	9
6	9	7	9	6	8	9	5	4	7
8	6	5	9	8	4	7	6	8	3
7	6	7	3	2	8	4	8	7	6
5	8	6	7	9	6	6	9	3	8
9	7	8	6	6	9	7	2	2	6
6	7	8	8	3	8	9	3	5	7
8	9	5	4	8	5	6	8	3	9
9	7	6	7	4	6	8	7	7	4

ADDING HIGH

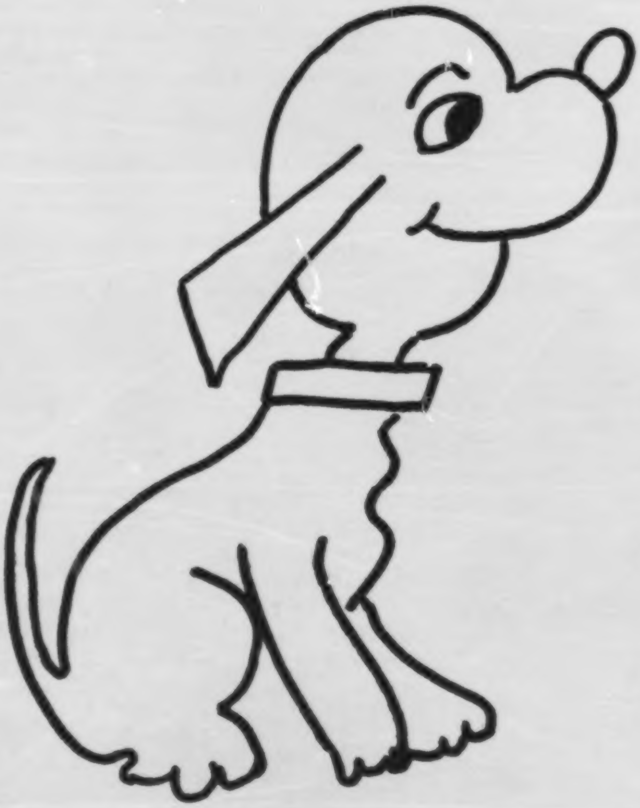
Materials:	Set of 40 cards, ten each of digits 0 to 9 Score sheets
Players:	2 to 5 (double deck for more than three players)
Directions:	Deal three cards to each player Arrange cards to make the highest number you can. Say your number. The player with the highest number adds that number to his or her score. Play ends when three more cards cannot be dealt to each player. Winner is the player with the most points at the end of the game.

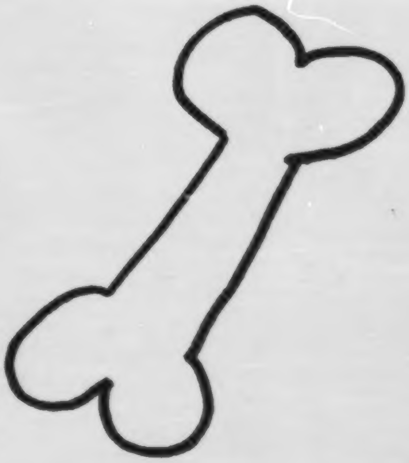
PERKY PUPS

Materials:
- 4 pups on tagboard
- 36 bones on tagboard
- 4 magic slates

Procedure: Write the numbers 1 - 9 on the bones. Decide on order of players first thru last. Give a pup to player. Place bones number side down on table.

Instructions: First player turns over two bones; add the two numbers and and writes the answer on his slate. Play continues until it is the first players second turn. After choosing his two bones and adding them together he places the answer under the preceding number on slate. He then adds the two numbers together. Play continues until all bones have been turned over; player with highest score is winner.





SUBTRACTION OF WHOLE NUMBERS

Introduction

When a child understands the concept of place value and the process of regrouping, and when he knows the basic subtraction facts, he will be able to find the answer to any subtraction problem involving whole numbers. This section concerns all three of the above rudiments of subtraction.

When a child is working a subtraction problem involving two-digit numbers, the MIP must make sure he subtracts the number of ones before he does the tens.

NOTE: When working with three digit numbers in subtraction (no regrouping), use the same activities as you did with two digit numbers. Remember to stress that the children must first subtract the ones, then tens and finally the hundreds. If you want to use manipulative materials, try using a toothpicks. A bundle of one hundred toothpicks is not as bulky as a bundle of counting sticks.

Use the worded problems found in the adopted text for the application of multi-digit subtraction. If you make up your own subtraction problem, please make them realistic.

Once the students master the concept of renaming, in order to subtract the numbers, they will no longer need the sticks.

CONCEPT: Subtraction of two-digit numbers

ipment: Toothpicks, popsicle sticks, coffee stirrers

Activity 1: Give each student bundles of tens and single sticks. Review the various ways a number of sticks can be regrouped, e.g., 5 tens 4 ones, or 4 tens 14 ones, or 3 tens 24 ones, etc. Do this with several examples.

You may want to establish the concept of subtraction with your students. Usually the student thinks of subtraction as "take away." Write 4 tens 3 ones on the board. Pick up 4 bundles of tens and 3 single sticks and ask one of the students to come up and take 18 sticks from the quantity. A class discussion should develop about how the student will have to take a ten apart before 8 ones can be removed. The procedure for finding the solution to the subtraction problem should be recorded on the chalkboard. The recording should be as follows:

3 tens 13 ones
~~4 tens 3 ones~~
- 1 ten 8 ones

2 tens 5 ones

Give the students other problems to solve, being careful to discuss the solution of each and record the work on the board. During the discussion of each problem it is important that the student recognize that a ten had to be regrouped before the subtraction could be executed. Once the regrouping concept is recognized, then it should be established that this concept is no different than rewriting the number a different way. Make sure the students draw a line completely through the number they are renaming, with the new name written about the number.

Activity 2: Give each student bundles of ten sticks. Write a problem similar to 4 tens 0 ones and ask the students to subtract 6 sticks from these sticks. When the students have found the answer have one of them explain to the class how he arrived at his answer. Record the results on the chalkboard.

e.g. 3 tens 10 ones
~~4 tens 0 ones~~
- 6
3 tens 4 ones

Repeat with other bundles of ten sticks.

****

CONCEPT: Subtraction of two-digit numbers (no regrouping)

Equipment: Sticks, rubber bands, boxes labeled tens and boxes labeled ones

Activity: The MIP prepares some bundles of ten sticks and leaves the rest as single sticks. He then writes on the board a subtraction problem involving two-digit numbers (e.g., 34 - 23 =   ). A child can then represent the minuend (34), using sticks. He should use three bundles of ten sticks and four single sticks. He then performs the act of subtraction by taking away the number of sticks of the subtrahend (23). This means he will take away two of the three bundles of ten sticks and three of the four single sticks, leaving one bundle of ten and one single stick. Therefore, the answer is 11. It is important that the children understand the process of subtraction of two-digit numbers where no regrouping is necessary, before attempting problems involving regrouping.

****

CONCEPT: Subtraction of two-digit numbers (with regrouping)

Equipment: Sticks

Activity: The children are given a subtraction problem involving two-digit numbers, where regrouping is involved in finding the answer (e.g., 63 - 27 = 27 =   ). After the child has represented 63 with sticks (six bundles of ten and three singles), he finds that he cannot take seven sticks away from three sticks. The children will then need time to determine how this difficulty can be overcome. Hopefully, someone will suggest taking the rubber band off of one of the bundles of ten sticks to make more single sticks (in order that the subtraction may be accomplished). After taking off the rubber band, the child has five bundles of ten and thirteen singles - from which he takes away two tens and seven singles, leaving three tens and six singles. The answer is 36.

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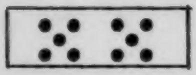
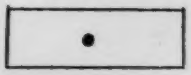
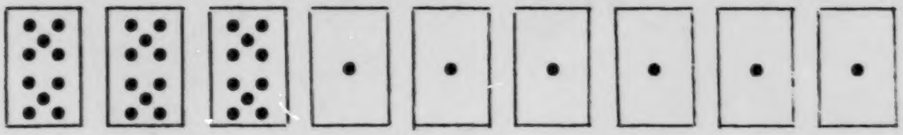
CONCEPT: Subtraction of two-digit numbers (no regrouping)

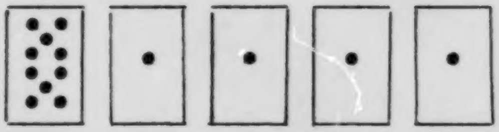
quipment: Individual flannel boards, sets of ten and sets of one

Activity: Rectangular strips of construction paper showing a set of ten dots  and a set of one dot  are prepared. A subtraction problem involving two-digit numbers and no regrouping (e.g., 36 - 22 = ☐) is given to the children.

They are to find the answer, using the paper strips on their flannel boards. They should represent the minuend (36) as shown:



After taking away the subtrahend (22), they should left



Therefore, the answer is 14.

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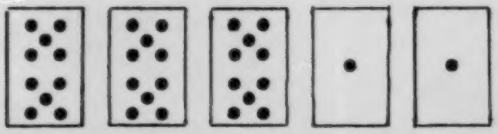
CONCEPT: Subtraction of two-digit numbers (with regrouping)

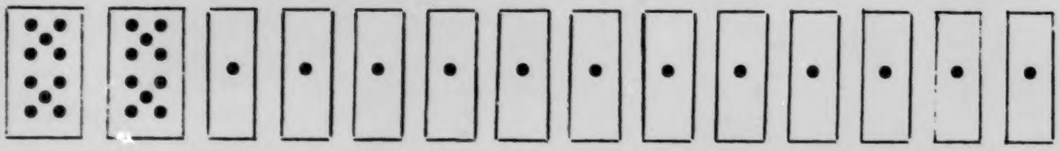
Equipment: Individual flannel boards, rectangular strips showing sets of ten and sets of one

Activity: A subtraction problem involving two-digit numbers and regrouping (e.g., 32 - 13 = ☐) is given to the children.

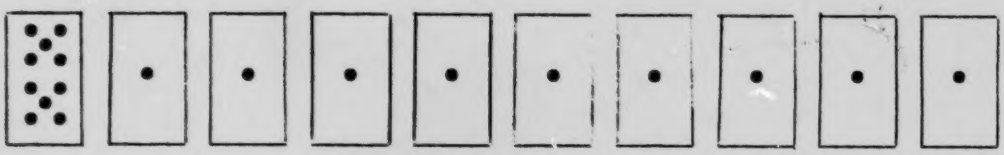
They are then asked to find the answer, using the paper strips on their flannel boards. The minuend would be represented as



The children will run into difficulty when they want to take away the three ones of the subtrahend from the two ones of the minuend. The children should help the MIP decide how this can be done. Someone will suggest exchanging one of the sets of ten for sets of one. The minuend now looks like this:



The children can now take away the subtrahend, leaving



Therefore, the answer is 19.

Equipment:	Individual chalkboards
Activity:	The MIP writes a subtraction problem, involving two-digit numbers, on the chalkboard. The children then copy the problem on their chalkboards and find its answer. When they are finished they should hold their chalkboards in the air for the MIP's observation

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FOUR WAY

CONCEPT: Review addition-subtraction and multiplication-division facts for whole numbers.

Materials: 45 cards cut from tagboard (2 x 3"), numbered as shown using 2 different colors for the numbers on the cards.

Number of Players: two, three or four persons

Procedure: The deck is shuffled and five cards are dealt to each player. One card is turned face up and the remaining undealt cards are put in a stack face down. The person at the left of the dealer is first.

Suppose the 6-2 card is the one that is face up. The number on this card may represent 6 + 2 = 8; 6 - 2 = 4; 6 x 2 = 12; or 6 ÷ 2 = 3. If the first player has a card with two numbers whose sum, or difference, or product, or quotient is 8, or 4, or 12 or 3, he may play the card from his hand by placing it face up on the 6-2 card.

If he does not have such a card in his hand, he must draw the top card from the stack and see if it can be played. If the drawn card cannot be played, it is added to the player's hand and he draws again. He continues till an 8, or 4, or 12, or 3 is found. When a card can be played, it is placed on the face-up pile and the next player takes his turn.

For example, assume the first player plays the 8-2 card, representing 8 ÷ 2 = 4, on the opening 6-2 card. The second player must now determine the new numbers that can be played. He may use any one of the four operations to name one of the new numbers, in this instance either 10 or 6 or 16 or 4.

Any time a card is played, another player may challenge the play by asking what that particular card can indeed be played. The game is won by the first person to play all his cards. If all the cards have been drawn and the game has not been won, all but the top card on the face-up, or discard, pile are reshuffled and the game continues.

Notice that the two numbers on some of the forty-five cards cannot be used to name four different whole numbers. The sum and the product may name the same number; or the product and the quotient may name the same number; or the operation of division may not yield a whole number. Since some cards are more likely to be playable than are others, there are opportunities to make strategic decisions.

Players of this game are continually mentally performing the operations of addition, subtraction, multiplication, and division.

DOWN FROM 500

Materials: Set of 40 cards, ten each of digits 0 to 9 score sheets

Instructions:

2 to 5 players
Mix the cards and place the deck face down on the table
Each player start with a score of 500
Each player draw two cards and makes the lowest number he or she can.
The player who can make the lowest number then subtracts the number from his or her score.
Play ends when all the cards have been drawn, or when one player's score reaches zero.
Winner is player with lowest score at end of game.

JAWS

Divers begin at start. Each diver takes a turn rolling the cube. As they land on a space, they must subtract that number of minutes of air that you use on that space from the 120 minutes each diver started with.

If a diver lands on a JAWS space, he must draw a JAWS card and follow the directions.

The first diver to make it safely to the surface (FINISH) first is the winner.

Example:

$$\begin{array}{r l} 120 & \text{minutes of air} \\ \underline{-6} & \\ 114 & \\ \underline{-3} & \\ 111 & \\ \underline{-9} & \\ 102 & \end{array}$$

Card Instructions for JAWS Game

1. You got scratched on some coral. Miss your next turn while you fix your wound.
2. Fight with an Octupus! Move back 3 spaces and subtract the minutes of air used.
3. Played with a dolphin. Go back 2 spaces. Don't forget to subtract the number of minutes of air you used.
4. Move ahead 1 space to study with a school of fish. You must subtract the minutes.
5. You got lost! Miss your next turn.
6. Oops! You tripped over a rock. Move ahead 1 space. Remember to subtract the minutes of air you lost.
7. Hide under the seaweed from an eel. Go back 2 spaces. Don't forget to subtract the minutes.
8. Wrestle with a shark! You manage to escape, but you are back 2 spaces and must subtract the minutes lost.
9. You got lost in a current! Move back 1 space and subtract the minutes.
10. Chase a dolphin! Move back one space. Remember to subtract the minutes of air you lost.
11. You got caught in some seaweed! Lose 1 turn while you get untangled.
12. You lost your flipper! Lose your next turn so you can find it.
13. SHARK ATTACKS YOU! Lose 1 turn.
14. Stop to repair your face mask. Lose 1 turn.

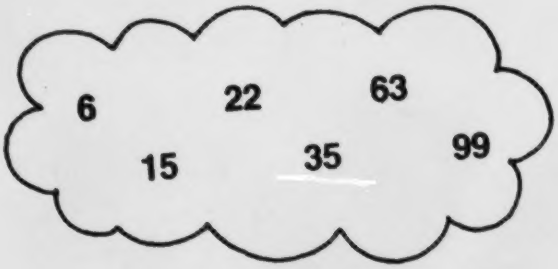
ADDITION - SUBTRACT STRATEGY

(1 and 2 digit with and without regrouping)

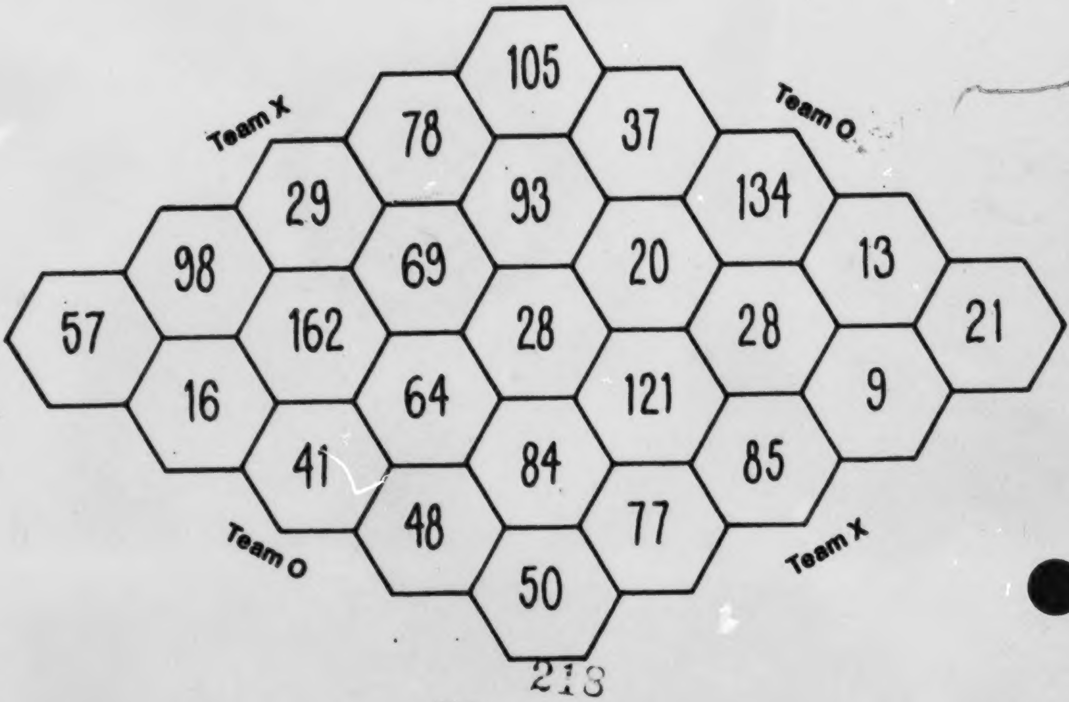
Materials: Posterboard or folder and markers

Procedure: Draw gameboard on posterboard. See diagram below.

Instructions: Two teams or two players.
The team or players take turns.
Each picks any two numbers from the cloud and adds or subtract the numbers.
If the sum or difference is on the gameboard, that team's or player's marker is placed on that sum or difference.
If it isn't on the gameboard, the turn is passed to other team or player.
The first team or player to get a path of answers conncecting its two sides of the game board wins.


6
22
63
15
35
99

Game Board


105
78
37
Team X
Team O
29
93
134
98
69
20
13
57
162
28
28
21
16
64
121
9
41
84
85
48
77
Team O
Team X
50

EQUIVALENT SETS AND SUBSETS

Introduction

If the elements of two sets can be matched in pairs so that no elements in either set are unpaired, then the sets are in one-to-one correspondence or equivalent. If this correspondence exists between several sets, they are all equivalent. A part of a set is called a subset. Equivalent subsets are obtained when sets with the same number of elements are formed (using elements from a given set). The study of equivalent subsets gives the basis of the concept of multiplication, which is the number operation associated with the joining of these equivalent subsets. If, for example, five sets of two elements are joined, the five names the number of sets, the two is the number in each set, and ten is the number of the union of the equivalent sets. The related number operation can be written as 2 + 2 + 2 + 2 + 2 = 10. This section will develop the basic concept of multiplication.

Concept: Equivalent subsets

Equipment: Blocks - construction paper circles

Activity: Children are given blocks and paper circles and are asked to make equivalent sets using as many counters and sets as they wish. (Example - Three sets of four)

****

Concept: Equivalent subsets

Equipment: Quiet counters, paper plates

Activity: Children are given designated number of plates and quiet counters. Using the sets (example - 3, 4, 5, 6, etc.), students make equivalent sets of counters on their plates and verbalize the results mathematically. "I have four sets of five." "I have three sets of two."

****

Concept: Equivalent sets

Equipment: Rings and teddy bears

Activity: Children place teddy bears in construction paper rings and verbalize the number of sets, number of counters and the number all together. Example - three sets of six makes eighteen. Children continue the above activities until all facts have been discovered. Then MIP would direct the activity by saying "show me three sets of four". "How many sets do you have?" "How many counters?" "How many do you have all together?"

****

Concept: Equivalent sets

Equipment: Individual flannel boards, objects for each child

Activity: The child is told to place a certain number of flannel objects on his flannel board (e.g., eight). He is then asked to divide these objects into equivalent sets (for the above example, either four or two sets). Another member of the class may give a verbal description of how many sets the first child has, how many objects are in each set, and the total number of objects on the board.

****

Concept: Equivalent sets

Equipment: Magnetic board, magnetic shapes

Activity: A set of shapes is placed on the magnetic board (e.g., ten). The children are told to arrange these shapes into a certain number of equivalent sets (for the above example either five or two). Then they are asked to give a verbal statement as to the number of equivalent sets, the number of elements in each set, and the total number of pieces on the board. If a child formed two equivalent sets for the above example, he would say, "Two sets of five makes ten."

****

Concept: Equivalent sets

Equipment: Overhead projector, objects to use on the overhead, overhead projector pen

Activity: A set of objects is placed on the overhead projector (e.g., six). A certain number of closed curves is then drawn (for the above example either two or three). One student fills the closed curves with elements from the given set, so that each will have the same number of objects. (If two closed curves are drawn for the above example, then each set would contain three objects.) The child is then asked to give a verbal description of the number of equivalent sets, the number of objects in each set, and the total number of objects on the overhead projector. For the above example the child would say, "Two sets of three makes six."

****

Concept: Equivalent sets

Equipment: Individual chalkboards

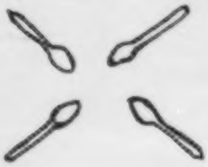
Activity: The children are told to draw four circles on their chalkboards. Two triangles are to be drawn in each circle. One child is asked to tell the number of circles, the number in each circle, and the total number of triangles he has drawn. He should say, "Four circles with two triangles makes eight triangles."

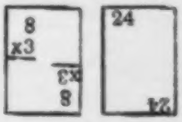
SPOONS OR OLD MAID

Materials:
52 - 3½" x 2½" cards
Spoons (1 less than the number of players you have.)
Make a deck of 52 cards with problems and answers

Procedure for Spoons: Arrange spoons in a circle in the middle of the table.

Examples:





The dealer deals out four cards to each player. The object of the game is to get two matches (a match is a problem and the answer) and to take a spoon trying not to let the other players see you take the spoon.

After the dealer deals out the cards he draws a card off the stack of remaining cards. He checks the card to see if he needs it in his hand to make a match. If he doesn't need the card he passes it face down to the next player to his left. If he does need the card he puts it in his hand and discards one he doesn't need passing it on to the next player. He draws again as soon as he passes the card on to the next player. Once a player has his two matches and takes a spoon the other players can take a spoon when he notices a spoon has been taken. Anytime a player takes a spoon it is more fun if he tries not to let anyone see him take it. Play continues until the player without a spoon notices that all the spoons are gone. The game can sometimes go on for quite a while before the player without a spoon notices they are all taken.

Every player that gets a spoon gets a point.

The next player is the dealer and the game starts over.

Old Maid Procedure: Use the same deck of cards except put 1 more card in with Old Maid on it.

The dealer deals out all the cards one at a time. Each player checks his cards to see if he has any books (a book is a problem and a answer). He lays his books on the table in front of him. The player to the left of the dealer draws from the dealer. Then the player to his left draws a card from him. Each time a player draws a card he checks his hand to see if he can make a book with the card he [illegible]. When a player is out of cards he is out of the game. The player left with the Old Maid is the loser.

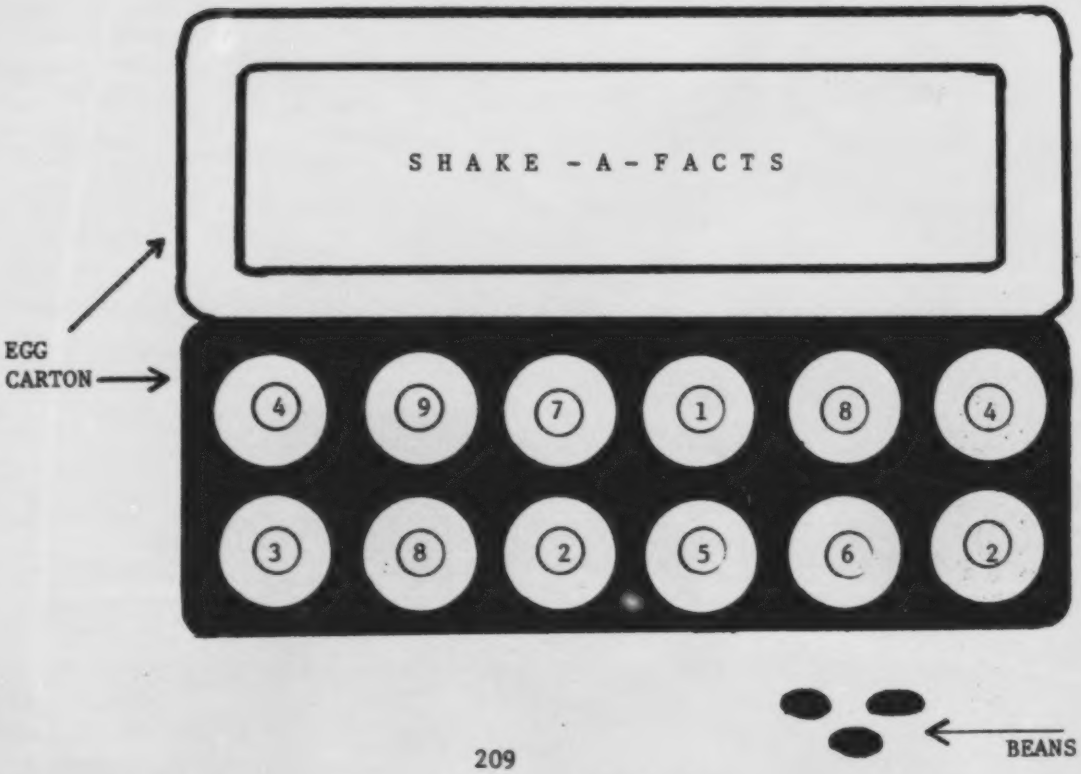
SHAKE-A-FACT

Materials:
egg cartons (1 for each child)
3 beans (for each child)
scratch paper
pencils

Procedure: Write a numeral (1 - 9) in each section of the egg carton with a magic marker. Write the following instructions on the top of the egg carton lid. a) Close lid; b) Shake carton; c) Record on the scratch paper the numerals where beans have landed.

Instructions: The child should place 3 beans in the egg carton. He should then close the lid of the carton and shake it vigorously. The beans will fall into various compartments. The child should open the lid and record the numbers on the bottom of the compartments where the beans have landed. The child must then find the sum of the numbers. See the illustration below.

NOTE: You could use two beans and require the children to add, subtract or multiply the two numbers.



GEO BOARD

Materials:

6" x 6" piece of 1/2" plywood
5" x 5" paper grid using 1" units
box of 5/8" nails
hammer
rubber bands in different colors

Procedure:

The plywood is sanded and painted. You could cover the board with contact paper. The grid is then put on top of the plywood. Nails are hammered into the grid to complete the geo board. Half of each nail should be left exposed. When the paper grid is torn off, the geo board is finished.

Instructions:

You can use the geo board to reinforce the concepts of addition, subtraction, multiplication and division. See the examples below:

Addition - 4 + 3 = ☐ could be represented on the geo board by banding 4 nails with one rubber band and 3 nails with a second rubber band. The sum would be the number of nails enclosed by the rubber bands.

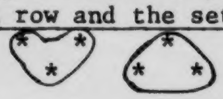
Subtraction - 8 - 3 = ☐ could be represented on the geo board by banding 8 nails with one colored rubber band and then band 3 of these nails with a different colored rubber band. The difference would be the number of nails within the first set not banded by the second rubber band.

Multiplication - 3 x 4 = ☐ could be represented on the geo board by banding an rectangular array of nails having the dimensions 3 nails by 4 nails. The product would be the number of nails enclosed.

Division - 12 ÷ 3 = ☐ could be represented on the geo board by banding 12 nails and then banding these nails into 3 equal sets. The quotient would be the number of nails in each set.

MULTIPLICATION FACTS

Introduction

The meaning of multiplication should be developed by reference, first to the joining of equivalent sets (e.g., when four different sets of six are joined the cardinal number of the union is 24), then to the addition of equal addends. (e.g., a short method for naming the sum 6 + 6 + 6 + 6 is to use the multiplication fact 4 x 6 + = 24). Before working with numbers in multiplication problems, the child should be given many experiences in joining equivalent sets. Then he can be shown how multiplication problems are related to these experiences. (e.g., 2 x 3 means two equivalent sets of three elements.) It is sometimes easier for the child to join the equivalent sets representing a multiplication problem if the sets are arranged in an array. An array is where the elements of the sets are placed in a row and the sets are positioned under each other. (e.g., the equivalent sets  would look like
* * * in an array).
* * *

The array above is described as a 2 by 3 array. Some activities involving arrays will be given in this section.

A third method of describing multiplication may be established from the general concept that every number has many names (conservation of numbers). The number 24 can be given several different multiplication names: 1 x 24, 2 x 12, x 8, 4 x 6, etc. In general, then, multiplication may be described as the renaming of two factors as a product. One of the factors corresponds to the number of equivalent sets and the other factor to the cardinal number of each set; the product corresponds to the cardinal number of the union of the sets.

All multiplications of whole numbers may be developed from the basic multiplication facts. Such facts involve two factors less than ten. There are 100 possible combinations, but the number of these which must be learned separately can be reduced by the use of three principles: The product of any number and zero is zero; the product of one and any other number is that number; the order in which two numbers are multiplied does not change the product (2 x 3 = 6, 3 x 2 = 6). The first two principles reduce (by 36) the number of basic facts that need to be memorized. Eight combinations involve a double factor (2 x 2, 3 x 3, etc.). When these have been learned, there are only 56 facts left. Because the order does not affect the product, only half of these 56 facts need to be learned separately. Thus, there are finally only 36 basic combinations to memorize. This section contains activities that allow the child many opportunities to learn these facts.

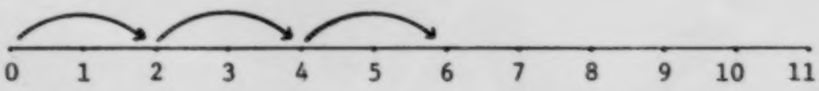
MULTIPLICATION - USING ARRAYS

In the preceding pages, the activities involved the forming of arrays for a given set or number, and then stating the multiplication number sentence associated with the array. The process can now be reversed by giving the child a multiplication problem and requiring him to form an array for it (e.g., give him 3 x 4 and he forms the array ....). This will enable the child to find the answer to the multiplication problem by finding the number of elements in the array.

****

MULTIPLICATION - NUMBER LINE

Multiplication problems can be stated as an equal addends problem. Therefore, the product can be reached by finding the sum of these addends. The number line can be used to find the sum of the addends, as described in the section on number lines. The number line gives the child another method of obtaining products. (e.g., 3 x 2 = _____, is the same as 2 + 2 + 2 = _____ whose solution on the number line is shown below:



2 + 2 + 2 =6 ⟷ 3 x 2 = 6

****

MULTIPLICATION - COUNTING

Most children entering the intermediate grades already know how to count by twos and by fives. Practice in counting by threes, fours, sixes, sevens, eights, and nines, can be helpful in teaching the possible products for any specific multiplier. (based on equal addends.)

****

UNDERSTANDING THAT MULTIPLICATION IS COMMUTATIVE

Introduction

Knowing and understanding the concept of the commutativity of multiplication will require the child to learn only half as many multiplication facts. This is true because every non-double multiplication fact is one of a pair involving he same two numbers (e.g., 3 x 5 = 15 and 5 x 3 = 15 or 6 x 4 = 24 and x 6 = 24, etc.). Therefore, when a child knows one fact, he automatically knows two facts.

****

Concept: Multiplication - using arrays

Equipment: Counters (blocks, discs, buttons, etc.)

Activity: Each child is given the same number of counters (e.g., 12). He is asked to form an array with his counters. Members of the class can then be called on to show their arrays and to write the corresponding multiplication sentences on the chalkboard. Once the first sentence has been written, the Mathematics Instructional Paraprofessional should ask if anyone else has an array that represents the same sentence. If so, he is asked to show his array. A student with a different array then comes to the chalkboard and writes his sentence. This process is repeated until all students have shown their arrays. (The possible arrays for twelve counters are: 1 x 12, 2 x 6, 3 x 4, 4 x 3, 6 x 2, and 12 x 1). The students must count the members of an array by multiplying the number of rows times the number of objects per row. (e.g., three rows of four would be represented by 3 x 4).

****

Concept: Multiplication - using arrays

Equipment: Individual flannel boards, flannel objects

Activity: Each pupil is given the same number of flannel objects. The Mathematics Instructional Paraprofessional verbalizes a multiplication sentence while the pupils form a corresponding array of flannel objects for the number sentence on their flannel boards. This process is continued until all combinations are found for the number of given objects. (2 x 3 = 6; 3 x 2 = 6; 1 x 6 = 6; 6 x 1 = 6; if six objects are given to the student).

****

Concept: Multiplication - using arrays

Equipment: Individual chalkboards

Activity: The children are told to write a certain number at the top of their chalkboards (e.g., eight). Then they form an array having this number of dots (circles, triangles, etc.) below the number. The multiplication sentence associated with the array should be written at the bottom of the chalkboards. The children then hold their chalkboards in the air for the Mathematics Instructional Paraprofessional's observation. All of the different solutions are recognized.

****

Concept: Commutative property of multiplication

Equipment: Geoboards, rubber bands

Activity: The children form an array of nails on their geoboards, using a rubber band. They are then asked to give the multiplication number sentence associated with this array. The sentence is written on the chalkboard. Next, the children rotate their geoboards one fourth of a turn and write a new multiplication sentence on the chalkboard. Both number sentences will have the same product but the factors will be reversed.
e.g., * * *   * *
* * * becomes * * when rotated, and
* *
the equations are 2 x 3 = 6 and 3 x 2 = 6). This demonstrates the unimportance of order in multiplication (commutative property).

****

Concept: Commutative property of multiplication

Equipment: Multiplication chart

Activity: The students are shown a multiplication chart that provides all the names for a particular number. (e.g., 1 x 12 = 12; 2 x 6 = 12; 3 x 4 = 12; 4 x 3 = 12; 6 x 2 = 12; 12 x 1 = 12). In each case, the product of the two factors is twelve. It should be emphasized that 3 x 4 = 12 and 4 x 3 = 12. The class may then identify other pairs of numbers having the same product.

****

Concept: Number line multiplication

Equipment: Magnetic board, a magnetic character

Activity: Draw a number line on the magnetic chalkboard. Give the students a multiplication fact problem to work. Ask one of your students to use the magnetic character to demonstrate the procedure that should be used to find the answer on the number line. Repeat with several other examples.

****

Concept: Number line multiplication

Stage of Development: Semi abstract

Equipment: Individual chalkboards

Activity: Ask the students to draw a number line on their chalkboard. Give them problems to solve on their number lines. They are to show their work to the Mathematics Instructional Paraprofessional.

BEAT THE TEACH

Materials: One "Beat the Teach" board.
Different colored markers

Directions: A decision is made as to who has the first turn. That challenger chooses two numerals at the top of the board Two different markers are placed at these numerals. If the classroom is first, a student chooses two numerals, multiplies them together and that challengers mark is put on the product. Use X's and O's. Turns are alternated between teacher and class, with different members of the class responding. The first challenger to get three products in a row is the winner. The objective for the class is to "Beat the Teach."

1	2	3	4	5	6	7	8	9
		1	2	3	4	5	6	
		7	8	9	10	12	14	
		15	16	18	20	21	24	
		25	27	28	30	32	35	
		36	40	42	45	48	49	
		54	56	63	64	72	81	

HELPFUL HINTS FOR MULTIPLICATION TABLES

"9" rule

Any number multiplied by "9" will have an answer that begins with one number less than the number multiplied by.

Example:

$$\begin{array}{r} 9 \\ \underline{\times\ 6} \end{array}$$

9 x 7 = 63

To remember 7 x 8 = 56 the numbers are in succession "5" "6" "7" "8"

To remember 9 x 9 = 81 the answer is 9 + 9 reversed

MULTIPLACE

This a game for two or more players. It may be played in a variety of ways. It is a good game to teach place value and practice of the multiplication tables and other basic math facts.

Materials:

a score card for each player
score chips
2 dice

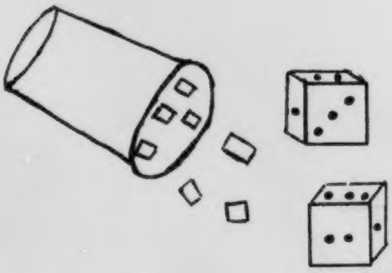
Directions:

To start the game the players take turns rolling the dice to see who will be first. The players rotate in a clockwise manner. When the first player is established, he rolls the dice and multiples the dots to figure his score. Then the amount is put on his place value score card. Each time the player adds his score to his score card (manipulting the chips on the place value card). After ten turns the highest score wins the game.

Other varieties of the game: Doubling the value of one or both of the dice so that practice of 12's is possible.

An extra dice may be used to add a second fact, such as addition or subtraction.

(After practice is established, the game can be played without the use of the score cards, using the chips in their correct place value locations.)

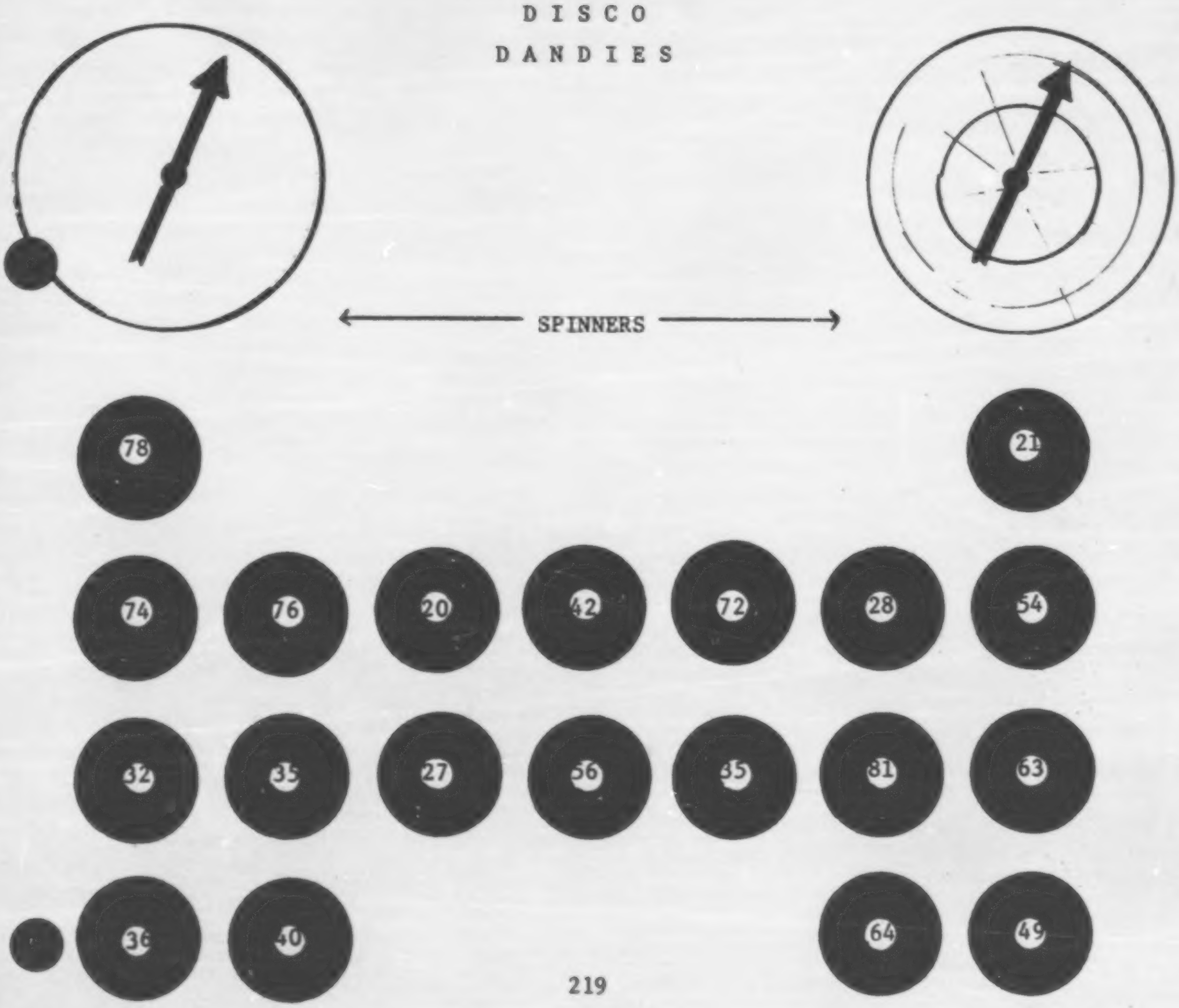


MULTIPLACE

1,000	100	10	1's

DISCO DANDIES

Material:	spinners (2-9, 4-9) gameboard (see illustration) c colored chips for each player
Instructions:	Players each spin to see who gets the highest number. This person is the first player. Player then spins both spinners, states the multiplication sentence and covers the answer on the gameboard. Next player does the same but may cover the answer only if it touches an answer already covered. The winner is the player who has the most chips on the board.


D I S C O
D A N D I E S
SPINNERS
78
21
74
76
20
42
72
28
54
32
35
27
56
35
81
63
36
40
64
49

KNOCK YOUR BLOCK OFF

Materials:

10" x 10" piece of styrofoam or tag board
magic marker
2 cubes, from 4 -9
counting blocks

Procedure:

Mark off board into 20 squares. At random, put the answers to multiplication problems ranging from 4 x 4 to 9 x 9 in the squares. Using 36 only once, there are 20 answers.

Instructions:

Each player is given ten counting blocks of the same color. The first player rolls the two cubes and multiples the numbers together. He then places one of his cubes on the answer to his problem. If his problem is 6 x 6, he places his block on 36. The second player then rolls the cubes. He rolls 5 x 4, and places one of his blocks on 20. When a player rolls a problem whose answer is covered by another player's block, the player whose turn it is may remove the other player's block and put his own on the board. The first player to get four blocks in a straight row is the winner. If a player answers his problem incorrectly, he may not put a block on the board.

10"

10"

20	42	12	10	16
49	25	36	12	18
24	40	21	15	8
30	14	6	28	35

3-IN-A-ROW

terials: Color parquetry chips (each player has different color)

Procedure: Make game board as below.

1. Each player in turn, rolls the dice, multiplies the two numbers together, and places a marker on that product on the playing board.
2. A player may put his marker on a space already occupied and the space becomes his (it may be used to prevent a player from getting three in a row).
3. The first player to have markers on three products in a row - vertically, horizontally, or diagonally wins the game.

36	54	35	45	20	30
42	49	24	63	48	56
35	32	16	25	40	28
56	28	64	81	54	42
20	45	30	24	72	36
48	36	40	72	32	63

HIGH ROLLERS

Materials

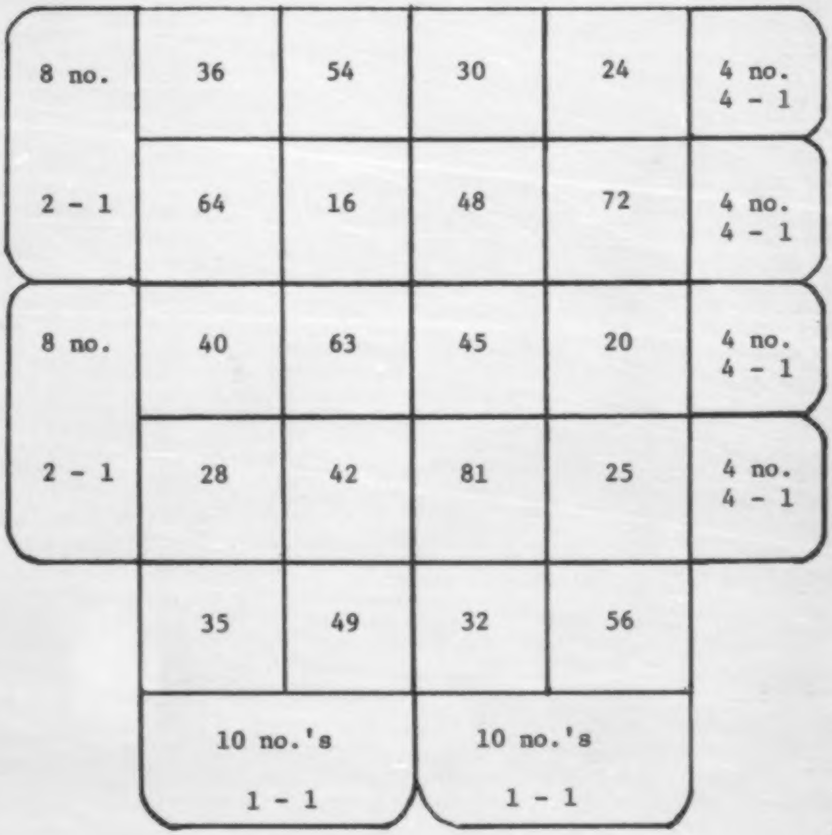
Poster board
Magic Markers
Poker chips
1 set of die with numbers 4-9 on them

Procedure: Construct a game board as shown.

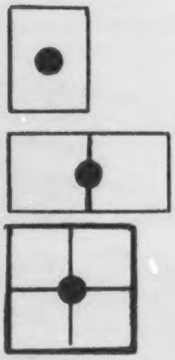
Instructions: Each student places a chip on a number that he thinks might come up as an answer. He can cover one number, two, four, eight, or ten numbers. The "pay off" rate is shown.

Example: Student #1 covers only the number 35. Student #2 covers four numbers (including 35) and student #3 does not cover 35. If 35 is the answer, student #1 gets 15 chips; #2 gets 4; and #3 has to pay one.

The student with the most chips at the end wins.



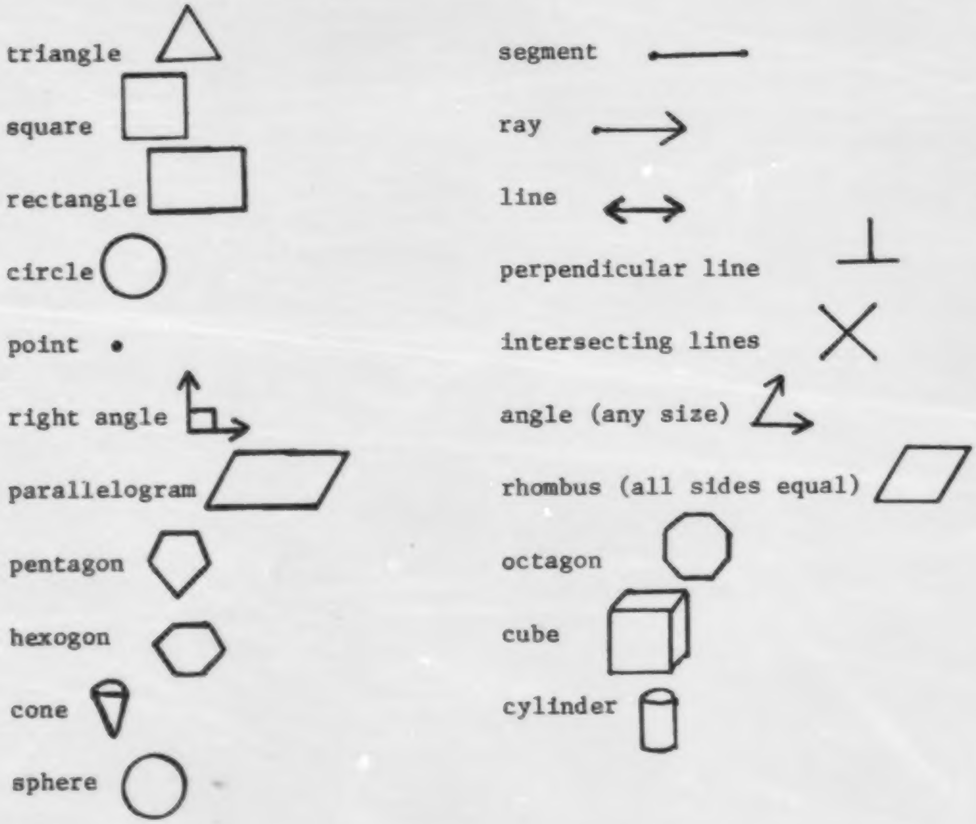
8 no.	36	54	30	24	4 no. 4 - 1
2 - 1	64	16	48	72	4 no. 4 - 1
8 no.	40	63	45	20	4 no. 4 - 1
2 - 1	28	42	81	25	4 no. 4 - 1
	35	49	32	56	
	10 no.'s 1 - 1		10 no.'s 1 - 1		



SYMBOLS

Introduction

The section of the skill sheet labeled symbols includes those symbols associated with computation, money, measurement and geometry. The learning of the symbols (+), (-), (x) and (÷) is accomplished in addition, subtraction, multiplication and division sections of this book. The symbols ($) and (¢) will be studied in the sections on money. The symbols (%), ( ) and (°) can be found in the section on mathematical application. The use of the symbols ( ) and ( ) will be discussed in this section. The rest of the symbols are geometric. When we are speaking of geometric symbols we are only concerned with the student being able to recognize the geometric figure when drawn on paper or expressed on a two-dimensional surface (flannel board, chalkboard, magnetic board, overhead projector, etc.). Several activities can be found relative to recognizing the shapes; triangle, square, rectangle and circle. The list of geometric symbols are given below.


triangle
square
rectangle
circle
point
right angle
parallelogram
pentagon
hexogon
cone
sphere
segment
ray
line
perpendicular line
intersecting lines
angle (any size)
rhombus (all sides equal)
octagon
cube
cylinder

CONCEPT: Greater than, less than

ipment: Individual flannel boards, objects, flannel pieces showing words: greater than, less than

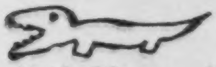
Activity 1: A set of objects is placed on the demonstration flannel board. The children then are told to form a set on their flannel boards that has "more" objects than the one on the demonstration board. After checking their results, the teacher asks them to form a set that has "fewer" characters. This can be repeated with different sets being placed on the demonstration flannel board. The phrases "greater than" and "less than" can also be used.

Activity 2: Two sets of objects are placed on the demonstration flannel board-leaving a space between the sets. The children put the word card greater than or less than on their flannel boards, making a true comparison of the cardinal numbers of the two sets. Their boards are then held in the air for the MIP's observation.

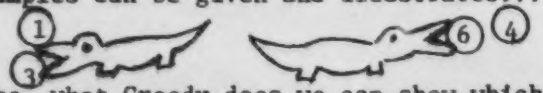
CONCEPT: Symbols < >

Equipment: Chart paper, marking pen

Activity: After children have developed an understanding of the concept of "greater than", and "less than", the following story can be developed with the children:



This is Greedy, the alligator. He lives in Math River. He is always very hungry. When Greedy sees numerals floating in the river, he always eats the largest numeral. If he sees a 5 and a 2, he will eat the 5. (Several examples can be given and illustrated...



When we write what Greedy does we can show which one he eats by drawing only his mouth. When we read what he eats, we are careful to read from left to right. If he eats the first (left hand numeral) we say _____ is greater than _____. When he eats the second numeral (right hand numeral) we say _____ is less than _____. (This story can be further developed using examples of combinations he sees in the river, e.g. 2 + 3, 1 + 2. Greedy would eat 2 + 3, shown 2 + 3 ⓶ 1 + 2.)

CONCEPT: Symbols

Equipment: Number lines

Activity: Each child is given a number line. When comparing numbers on the number line, the number which is the closest to zero will be the smallest number, and the one farthest from zero will be the largest number. Three numbers that are on the child's number line are written on the chalkboard. The children are then asked to use their number lines to determine the smallest number and the largest number. This should be repeated with several other triple numbers.

****

CONCEPT: Shapes

Equipment: Geo boards, rubber bands

Activity: The children are told to form a triangle on their geo boards, using a rubber band. Some of the properties of a triangle should then be discussed. (How many sides? How many corners?) Next, the children form a rectangle on their geo boards. Its properties are discussed. Finally, a square is formed and its properties are discussed.

****

Equipment: None

Activity: The children are told to search the room for shapes that are similar to the geometric shapes being studied (circle, square, rectangle, and triangle). A contest can be made out of this by seeing who can find the most shapes.

****

CONCEPT: Geometry - shapes

Equipment: Overhead projector, geometric shapes (triangle, square, rectangle, and circle)

Activity 1: One of the geometric shapes is placed on the overhead projector. Someone is asked to identify it. A different shape is then put on the projector and the procedure repeated. This is continued until all the different shapes have been identified.

Stage of Development: Semi-abstract

Equipment: Individual chalkboards

Activity: The children are told to draw triangles on their chalkboards. They must be able to tell the number of corners that a triangle has. Then, they draw rectangles. They should hold their chalkboards in the air for the MIP's ovservation. Last, they draw circles and squares. These two will cause them some difficulty.

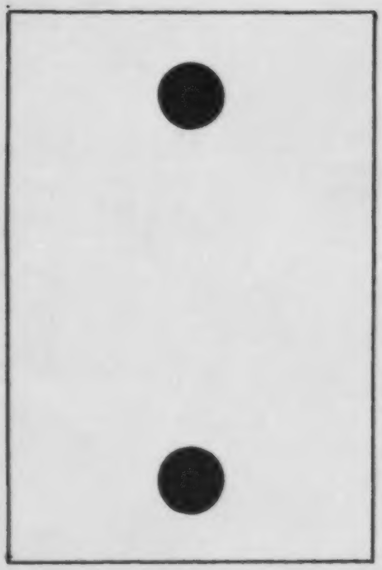
Note: The activities for learning the geometric symbols were centered on the geometric shapes, triangle, square, circle and rectangle. The same activities can be used for all the different geometric symbols by adapting the activity to fit the symbol.

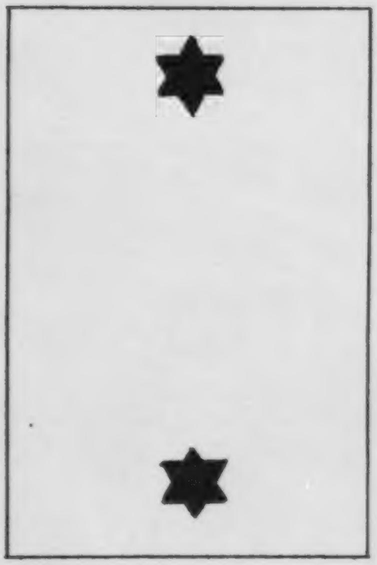
RUMMY - GEOMETRIC

terials: 56 - 3" x 5" cards with the following shapes on them. (There are two shapes on each card.)

- 4 yellow circles
- 4 red circles
- 4 red hearts
- 4 blue hearts
- 4 yellow diamonds
- 4 green diamonds
- 4 blue triangles
- 4 blue squares
- 4 green squares
- 4 green rectangles
- 4 orange stars
- 4 orange rectangles
- 4 blue stars
- 4 brown triangles

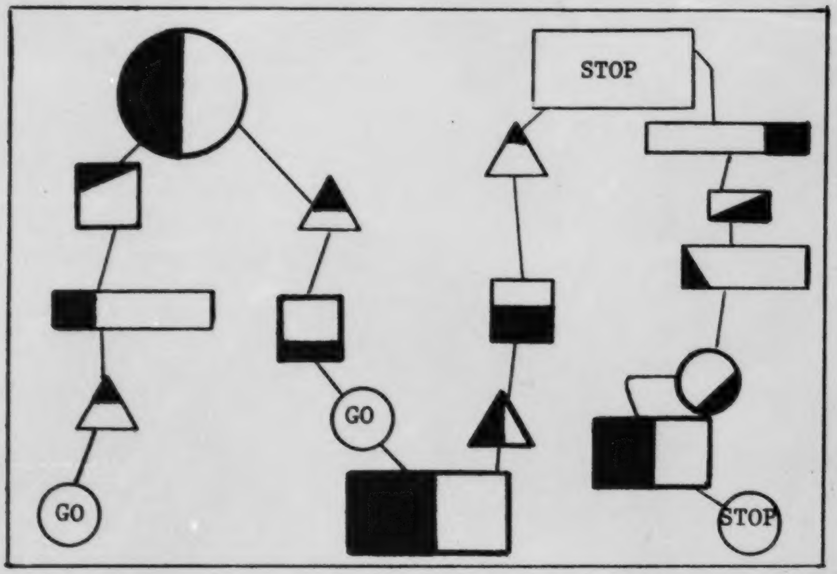
Procedure: Each player is dealt 4 cards the remaining cards make up a deck called the "Bone Pile." They are placed in a stack upside down between the players. The object of the game is to form books. A book consists of two cards having the same shape and color. The first player starts the play by drawing a card from the "Bone Pile." If he has cards that make up a book, he announces his book by telling the color and shape of the figures on the cards. He places the books in front of him and discards one card from his hand, then play continues around the group. When one of the players is able to form books for all of his cards, he is declared the "First Place Winner."





IS IT??

Materials:	Follow the construction directions for the basic step-a-se game board.
Procedure:	The steps on the pathway are geometric figures which have been divided into fractional parts. (circles, squares, triangles, rectangles, etc.)
Instructions:	Each pupil in turn rolls the number cube and moves that number of spaces on the game board. He identifies the geometric shape and answers the question "Is it divided into halves?" The pupil receives 1 point for identifying the shape correctly and 1 point for answering the problem correctly. The child with the most points at the finish wins the game.
Note!	The game could be changed by asking the question, "Is it divided into thirds, fourths, etc."



INEQUALITY GAME

Materials:

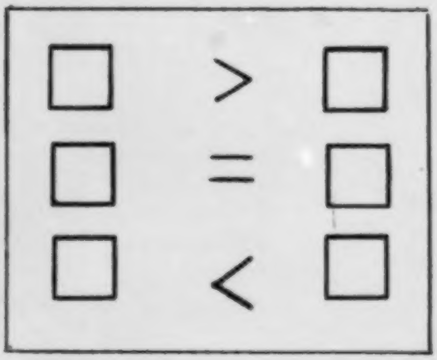
1 - 6" x 8" piece of styrofoam
6 - counting cubes
1 - can
1 - 6" x 8" piece of cardboard

Procedure:

Square holes large enough to hold the counting blocks are cut in the styrofoam (as shown in the following illustration). The 6" x 8" piece of cardboard is glued on the back of the styrofoam. The symbols >, =, and < are placed on the board (as shown in the illustration). Numerals are made on the faces of the cubes.

Instructions:

1. Only two to four players are allowed to participate at any one time.
2. The six counting cubes are placed in the can.
3. A player rolls the cubes on the table, exposing the numbers of their top faces.
4. The player is asked to make as many correct number statements as possible, by placing the cubes into the holes of the inequality board. He must use the numbers shown on the top face of each cube.
5. The player finds the sum of the numbers played and records this as his score. The person with the most points at the end of the contest is declared the winner.



SPOOL MATCH

Materials:

12 Spools

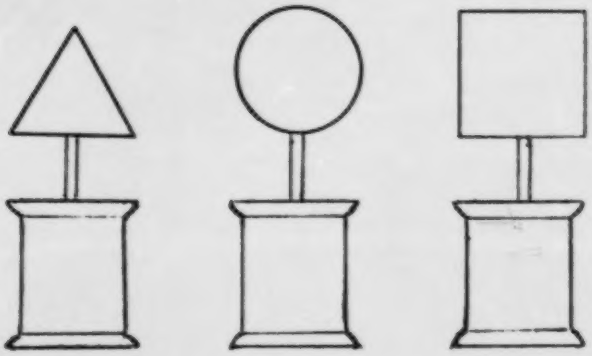
12 4" long dowels

Colorful construction paper

Procedure:

Insert a 4" long dowel in each of the 12 spools. Attach to the dowel a shape cut from colorful construction paper. Make each shape different, such as a star, circle, rectangle, diamond, etc.

Cut two construction paper shapes to match each of the shapes attached to the dowels. Make them of different colors so children must match by shape alone, not color. Place all these matching shapes in an envelope.



Instructions:

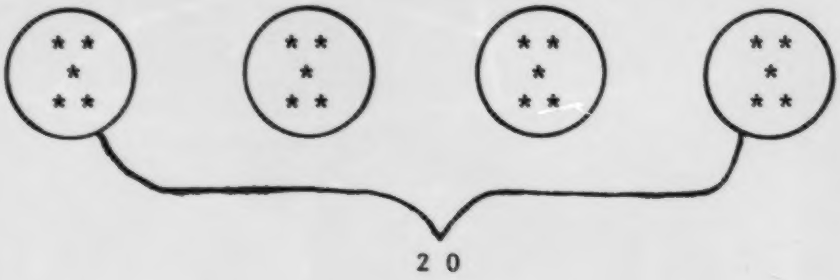
Place all the spools on the top of a table. Take all shapes out of the envelope and spread them out.

Have child pick up one shape and find a spool that has the same shape. Put the shape in front of that spool. Match the other in the same way. When child finishes he should have two shapes in front of each spool.

PARTITIONING SETS

Introduction

The prerequisite skill for the concept of addition is joining sets, for subtraction it is separating sets and for multiplication it is equivalent sets. To be consistent with these three computational skills, the concept of division should have partitioning sets as a prerequisite skill. An example of partitioning a set would be: You have 20 students in your room and you wish to divide them up into four committees. This could be accomplished by partitioning the 20 students into four sets of five students.



20 partitioned into 4 sets makes 5 in each set

$20 \div 4 = 5$

Concept: Partitioning sets

Equipment: Counters (dice, cubes, sticks, buttons, bottle caps, etc.)

Activity: Give each student two counters. Students should partition their counters into one set. Require the students to verbalize the number of counters in the set. Now have them partition their counters into two equal sets and state the number of counters in each set. Is it possible to partition the counters into more than two sets?

Repeat the above procedure using sets that contain more than two counters. After each attempt at partitioning, the following questions should be answered: How many counters all together? How many different sets? How many in each set? Are there any counters left over?

If you will repeat this procedure with your students for sets of 1 to 81 counters and partition them into one to nine sets, using only the cases when there are no counters left over, your students will be able to discover all of the basic division facts of arithmetic.

Furthermore, if you will construct a chart of the results on the chalkboard, these facts will become apparent. See the sample chart on the following page.

Total Counters ÷	Number of Sets =	Number of Counter in each Set R	Number of Counters left over
.	.	.	.
.	.	.	.
.	.	.	.
4	1	4	0
4	2	2	0
4	3	1	1
4	4	1	0
.	.	.	.
.	.	.	.
.	.	.	.
32	8	4	0
.	.	.	.
.	.	.	.
.	.	.	.

****

Concept: Partitioning sets

Equipment: Dried peas or beans, egg cartons

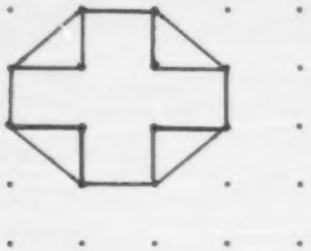
Activity: Give each student a certain number of beans and an egg carton. The students then partition these beans into different equal sets, using the compartments of the egg carton to hold the beans. e.g. If you give the student six beans, he will partition the beans into one set, two sets, three sets, four sets, five sets and six sets. When the partitioning leaves no beans left over, you have identified one of the basic division facts. Six (6) beans partitioned into 2 sets of beans leaves no beans remaining would represent the division fact 6 ÷ 2 = 3.

****

Concept: Partitioning sets

Equipment: Geoboards, rubber bands

Activity: Give each student a geoboard and several rubber bands. Each student encloses a certain number of nails of the geoboard with a rubber band. He is then instructed to partition this set into a number of equal sets using smaller rubber bands. See the illustration below for 12 nails partitioned into 4 sets.



12 ÷ 4 = 3

Using different colored rubber bands for the partitioned sets makes for their easy identification.

Using a 5 x 5 geoboard limits the study of the division facts to 25 ÷ 5 level.

Use butter tubs, paper plates, or other containers to contain the different sets.

****

Concept: Partitioning sets

Equipment: Magnetic chalkboard, magnetic characters

Place a certain number of characters on the magnetic board. Require the students to partition this set into a certain number of equal sets. e.g. Given 10 characters partition into 5 sets. Record the total number of characters, the number of sets, how many characters are left over after partitioning.

The preceding example would yield the following data: 10 characters partitioned into 5 sets of 2 characters with 0 remaining. Later, this will be identified with the division fact 10 ÷ 5 = 2 or written another way

$$\begin{array}{r} 2 \\ 5\overline{)10} \\ \underline{10} \\ 0 \end{array}$$

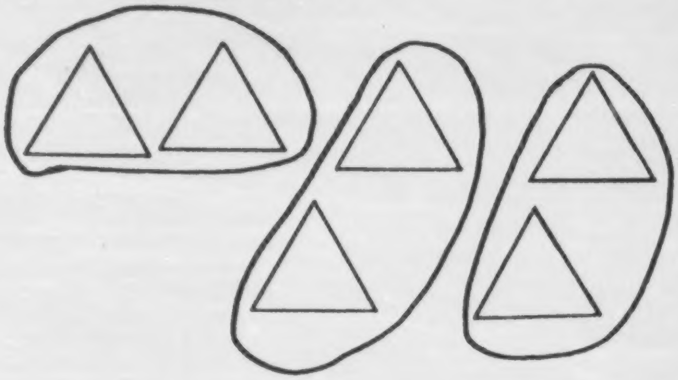
Repeat with other sets to establish the basic concept of division.

****

oncept: Partitioning sets

Equipment: Individual chalkboards

Actitivity: Each student is required to draw a certain number of triangles on his chalkboard. Each student partitions his triangles into a certain number of equal sets by drawing an enclosed curve around them.
e.g. Draw 6 triangles on the chalkboard and partition them into three equal sets.



Record your results as: 6 triangles partitioned into 3 sets of 2 triangles which yields, $6 \div 3 = 2$.

Repeat with other sets to identify other basic facts of division.

****

Concept: Partitioning sets

Equipment: Overhead projector, overhead projector characters

Activity: Place a certain number of characters on the overhead projector. Require a student to partition these characters into different numbers of equal sets. After each act of partitioning, have the student verbalize the number of characters they started with, the number of sets they were partitioned into, the number of characters in each set and the number of characters remaining.

****

DIVISION FACTS

Introduction

Multiplication and division are inverse (opposite) operations, for example, 6 x 2 = 12 and 12 ÷ 2 = 6, 8 x 3 = 24 and 24 ÷ 3 = 8. Therefore, the student who knows the basic facts of multiplication and understands the concept of division that is established in the section on partitioning of sets, will have no difficulty learning the basic facts of division. Remember, the basic facts of division are those division problems having divisors and quotients that are a single digit and having no remainder.

Example: $18 \div \underset{\text{divisor}}{2} = \underset{\text{quotient}}{9}$ or $\begin{array}{l} \quad 9 \text{ ----quotient} \\ 2\overline{)\,18} \\ \text{divisor} \end{array}$

This section will consist of various teaching suggestions for learning the basic computational skills of division. It is not enough that the students understands the basic concept of division, he should also be able to give the answer to any given division fact, instantaneously. e.g. If someone asks a student, "what is twenty divided by four?" the student should respond "five" immediately without hesitation. The student really does not know his division facts until he is able to do this. A firm command of the basic division facts is critical for the student's mastery of long division problems.

STAY WITH THE ABOVE FACTS UNTIL THEY LEARN THEM.

Concept: Division facts

Equipment: Counters, (discs, buttons, beans, sticks, etc.)
Containers (paper plates, paper cupts, butter tubs, egg cartons, etc.)

Activity: Write one of the division facts on the chalkboard.

(e.g. $12 \div 3 = \boxed{}$ or $3\overline{)12}$) Give each student several counters and containers. Each student uses his counters and containers to represent the division problems. For the above example, the student would place twelve counters into three containers. He would end up with four counters in each container. Four represents the answer of the division fact. Continue the activity, writing different division facts on the chalkboard.

Note: To add variety to this activity, change the counters and containers for the lesson presentation on different days. (e.g. use discs and paper plates one day, beans and egg cartons another day, sticks and butter tubs another day, etc.)

****

Concept: Division facts

Equipment: Geoboards

Activity: The basic division facts can be represented by use of rectangular arrays.

e.g. $8 \div 4 = \boxed{2} \longleftrightarrow 4\overline{)8}$

. .   would be where 8 dots (divided) can
. .   be represented as 4 rows (divisor)
. .   and 2 columns (quotient)
. .

Another example might be: $10 \div 2 = \boxed{5}$

. . . . .   10 dots as 2 rows
. . . . .   and 5 columns

Give each student a geoboard and a rubber band for each division fact given, the student uses his rubber band to form a representative rectangular array of nails on his geoboard.

Remember, the total number of nails represents the dividend, the number of rows, the divisor, and the number of columns, the quotient. Repeat for the various division facts, always recording the answer.

****

Concept: Division facts

Equipment: Magnetic board or flannel board (characters)

Activity: Write on the chalkboard, expose or verbalize one of the division facts to the students. Require one of the students to represent the division fact using the magnetic or flannel board and its characters. The students would do this by first selecting a number of characters equal to the dividend of the problem, then partitioning these characters into a number of sets designated by the divisor. The answer to the division problem will be the number of characters in each set. Make sure that students understand this process as it will play an important part when they study long division.

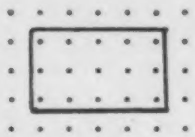
Repeat the above activity with the different division facts, always identifying the answer.

****

Concept: Division facts

Equipment: Overhead projector, rectangular coordinate dot grid transparency, ⁝⁝⁝ etc., overhead projector pencil.

Activity: Place the dot grid transparency on the overhead projector. Use at least a nine dot by nine dot grid. Write one of the basic division facts on the chalkboard. Someone represents the fact on the transparency by drawing a line around an appropriate rectangular array of dots. e.g. Given the fact $15 \div 3 = \boxed{}$ or $3\overline{)15}$, the student would encircle an array similar to the following:



3 rows and
5 columns

Repeat with different basic facts and students.

****

Concept: Division facts

Equipment: Individual chalkboards

Write one of the division facts on the chalkboard. The children are told to draw a rectangular array on their chalkboards that would represent the problem.

e.g. $18 \div 3 = \boxed{} \longleftrightarrow 3\overline{)18}$, the student would form the array on his chalkboard.

. . . . . .
. . . . . .   3 rows and 6 columns, with six
. . . . . .   being the answer to the problem.

Repeat with other problems.

****

Concept: Division facts

Equipment: Teacher made machines (self teach sheets, cartridge math machine, cardboard math machines, etc.), teaching aids (Clip-O-Pin factboard, Album Answer, Folder Math, Pocket Math, and String-O-Math), see the Games and Teaching Aids book for construction instructions.

ctivity: There are two types of individual activities that students can utilize when learning the basic division facts. They may use materials where they can check their own answers or they may use materials where the teacher has to check the answers for accuracy. Some of the materials that are self checking are cardboard math machines, cartridge math machines and self teach sheets.

On these devices, the division problems are exposed to the students while the answers are hidden from view. After the student has recorded his answer, he checks it against the correct answer.

****

Concept: Division facts

(Small Group Activities)

Equipment: Small group games:

- Boing Boing
- Car Race
- Cat and Mouse
- Chalktray Math
- Figure 8 Race
- Fishing Derby
- Flower Game
- Funny Face
- Game Called War
- Grow Doggie
- King of the Hill
- Lay Around
- O Rats
- Snail-O-Math
- Snoopy
- Spill The Beans
- Trip to Happy Face
- Tug of War

MULTIPLICATION OF WHOLE NUMBERS BEYOND BASIC FACTS

Introduction

When the student has a firm understanding of the concepts of place value and regrouping and knows his multiplication facts well, he should have little difficulty working any multiplication problem involving whole numbers.

Use the same classroom games, interest center devices, and teacher-made machines that you used for reinforcement of the multiplication facts for the computation problems involving two digits by one digit, two digits by two digits, three digits by two digits and three digits by three digits numbers. Merely prepare the playing cards for these games to reflect the problems you wish to reinforce.

If a student has difficulties in multiplication of whole numbers beyond basic facts, it is necessary for the teacher to pinpoint the student's problem area. Is it in his multiplication facts or is it where to place his numbers in the answer or is it in column addition?

To determine the problem area, have the student isolate each separate multiplication before he does the entire problem. e.g., $\begin{array}{r} 376 \\ \underline{\times\ 4} \end{array}$

First step: $$\begin{array}{r} 300 \\ \underline{\times\ 4} \\ 1200 \end{array} \qquad \begin{array}{r} 70 \\ \underline{\times\ 4} \\ 280 \end{array} \qquad \begin{array}{r} 6 \\ \underline{\times\ 4} \\ 24 \end{array}$$

Second step: $$\begin{array}{r} 376 \\ \underline{\times\ 4} \\ 1504 \end{array}$$

If the student did the first correctly and not the second step, then the problem is not in multiplication, but in place value.

Note: When using 10 or 100 as a multiplier, the students will soon be aware that the multiplication can be accomplished by moving the decimal point of the multiplicand one place to the right for 10 and two places to the right for 100.

DIVID-O

ncept: Division Facts

Equipment:
3 cubes
1 set of cards

Activity

1) Roll the three cubes for highest total to decide who will start. Play progresses clockwise. Place markers on start.

2) Deal four cards to each player or team. Place the the remaining cards in the center marked DRAW. These cards show remainders.

3) After rolling the number cubes, arrange the top numbers in the division frame. Any combination that gives a quotient given in the first geometric shape can be used. However, if there is a remainder, the player must have a remainder card to match. He places the remainder card on discard stack and draw another. If he can make a combination that is in the shape in order he places his marker there. If a set time elapses before he makes a match he must pass to next player.

4) Play moves from station to station. Players may not skip a station and only one match is needed in each geometric shape.

5) A player may challenge someone he feels has given an incorrect quotient. If he was wrong, he may not move.

6) 2 to 6 players may play. Teams may assist each other.

Concept: Division

Equipment: Each child has chalkboard or slate board

Activity: For ÷ or -

Each child has chalkboard or slate board.
Give a number to be written on board such as "89"
Have each child in turn roll a numbered cube to determine his or her divisor. (Do not allow two numbers the same)
After the problems have been completed, roll a cube that has "H" for HIGH and "L" for LOW on all sides. If "H" comes up the one with the highest answer wins or "L" the lowest answer wins. Winner gets a chip--grand winner is one with the most chips at the end of class.

In doing +, -, or x where more than one digit is needed use different colored cubes, color coded to ones, tens, hundreds, thousands, etc.

Concept: Multiplication of whole number - word problems

Equipment: None

The Mathematics Instructional Paraprofessional should discuss with the student how to pick out the operation that must be performed when they are solving verbal problems. Point out that phrases like "How many in all?" and "How many in 5 boxes?" are often clues to multiplication.

Activity: The student can make up verbal problems, using multiplication, for the information contained in charts like the following:

Cake	1	4
Cost	15¢	?

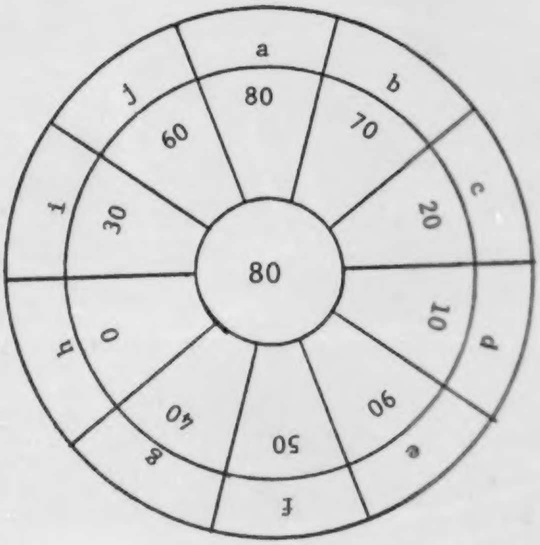
Truck	1	3
Wheels	14	?

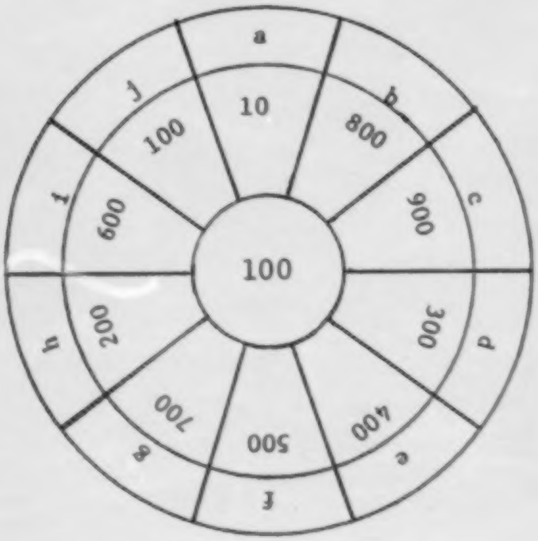
****

Concept: Multiplication of whole numbers

Equipment: Pizza rounds, clothespins or number cards

Activity: Find the product that would replace each letter in the multiplication wheel.

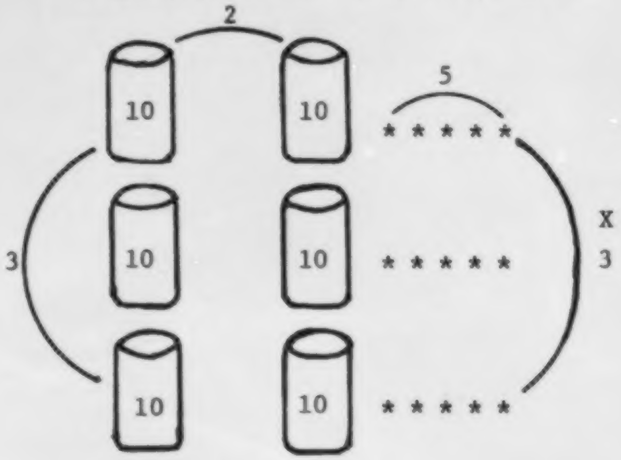

80
a
80
b
70
c
20
d
10
e
90
f
50
g
40
h
0
i
30
j
60


100
a
10
b
800
c
900
d
300
e
400
f
500
g
700
h
200
i
600
j
100

Concept: Multiplication of whole numbers

Equipment: Cans and objects

Activity: The students can use the cans and objects to show multiplications and write the products.



Tens	Ones
2	5
	3
7	5

****

DIVISION OF WHOLE NUMBERS

Introduction

Traditionally, the most difficult skill to teach children (or adults) in the realm of computation is the progress of long division. When you analyze the prerequisite skills, you can see why your students find it is so difficult.

They need to know: The addition facts, the subtraction facts, the multiplication facts, the division facts, the concept of renaming, the concept of place value, the concept of rounding off and the concept of estimating. All of the above skills are needed to successfully solve long division problems, but the two that retards the students understanding the most (if they are not understood) are the concepts of place value and renaming. The teacher should not begin the study of long division until the students have a firm understanding of these two concepts.

Note: Students will soon learn that dividing by 10 or 100 can be accomplished by merely adjusting the decimal point of the dividend. The decimal point is moved to the left one place when 10 is the divisor and two places when 100 is the divisor.

above the problem in the appropriate places. *That is, the number of tens each person receives should be placed above tens and the number of ones above the ones.

$$6\overline{)7\text{ tens }2\text{ ones}} \quad \text{and} \quad 3\overline{)4\text{ tens }2\text{ ones}}$$

Merely record the answer, do not show the division algorithm to the students at this time.

Activity #3:

Give each student several bundles and single sticks. Write a division problem on the chalkboard that involves a two digit dividend and one digit divisor that has a remainder. (e.g. $4\overline{)6\text{ tens }2\text{ ones}}$). The students should make up some kind of story that would be representative of the problem. Four boys had six tens and two ones (candy bars) that they would like to divide equally among them. The problem should be solved by using sticks. The results should be recorded as follows:

$$\begin{array}{l} \quad\ \ 1\qquad\quad\ 5\qquad\quad R\ 2 \\ 4\overline{)6\text{ tens }2\text{ ones}} \end{array}$$

This means that each boy would receive fifteen candy bars with two bars left over. Repeat with other examples.

tivity #4:

The following questioning technique should be utilized throughout the study of the concept of long division.

Example: $3\overline{)4\text{ tens }8\text{ ones}}$

Question: What is the first thing we divide among the three people?
Answer: Tens

Question: How many tens will each receive?
Answer: One

Question: Where do we place this answer?
Answer: Above the tens place because we are partitioning tens.

$$\begin{array}{l} \quad\ \ 1 \\ 3\overline{)4\text{ tens }8\text{ ones}} \end{array}$$

Question: How many tens are used?
Answer: Three

$$\begin{array}{l} \quad\ \ 1 \\ 3\overline{)4\text{ tens }8\text{ ones}} \\ \quad\ \ \underline{3\qquad\qquad\qquad} \end{array}$$

Question: How many tens do we have left?
Answer: One

$$\begin{array}{l} \quad\ \ 1 \\ 3\overline{)4\text{ tens }8\text{ ones}} \\ \quad\ \ \underline{3\qquad\qquad\qquad} \\ \quad\ \ 1 \end{array}$$

Question: Can we give any more whole groups of tens to the three people?
Answer: No

Question: What do we do with the group of ten?
Answer: We break it up into ones.

Question: How many ones do we have all together?
Answer: Eighteen

```
     1
   ____________
3 )4 tens 8 ones
   3
   ____________
   1      8
```

Question: How many of these ones should each person receive?
Answer: Six

Question: Where do we record this answer?
Answer: Above the ones place because we are partitioning the ones.

```
     1    6
   ____________
3 )4 tens 8 ones
   3
   ____________
   1      8
```

Question: How many ones did we use?
Answer: Eighteen

```
     1    6
   ____________
3 )4 tens 8 ones
   3
   ____________
   1      8
   1      8
   ____________
          0
```

Question: How many ones are left?
Answer: None

Question: What does the answer tell us?
Answer: Each person will receive sixteen sticks.

THIS SEQUENCE OF QUESTIONS SHOULD BE USED THROUGHOUT THE STUDY OF LONG DIVISION.

When working with the algorithm, the students will soon begin omitting the words hundreds, tens and ones from their work.

****

Concept: Three digit dividend, one digit divisor, no renaming no remainders.

Equipment: Sticks bundled into hundreds, tens and ones

Activity #5: Make up a story problem involving a division problem with a three digit dividend, one digit divisor and no remainder. Example, there are 484 cows needing to be herded into 4 cattle pens. How many cows should be placed into each pen. The algorithm would look like this:

```
   _________________________
4 )4 hundreds 8 tens 4 ones
```

If the student is going to represent the problem with sticks he will need 4 bundles of hundreds, 8 bundles of tens and 4 single sticks. Be sure and use the questioning technique discussed in Activity #4. The student would first partition the bundle of hundreds into four groups. Each group would get one bundle.

```
   1
   _________________________
4 )4 hundreds 8 tens 4 ones
   4
   _________________________
   0          8
```

The student would then partition the bundles of tens into four groups. Each group would get two bundles.

```
   1
   _________________________
4 )4 hundreds 8 tens 4 ones
   4
   _________________________
   0          8
              8
   _________________________
              0      4
```

The last things the student would do is to partition the single sticks into four groups. Each group would get one stick.

```
   1          2      1
   _________________________
4 )4 hundreds 8 tens 4 ones
   4
   _________________________
              8
              8
   _________________________
              0      4
                     4
   _________________________
                     0
```

The answer would be 121 cows should be placed in each pen.

****

Concept: Three digit dividend, one digit divisor, with renaming

ipment: Individual chalkboards

Activity #6: Write a division problem on the chalkboard. Use a problem which has a three digit dividend, one digit divisor which involves the process of renaming.

Example: $3\overline{)4 \text{ hundreds } 4 \text{ tens } 7 \text{ ones}}$

At this point you may want to drop the number words ($3\overline{)447}$). Four hundred forty seven books are to be distributed to three schools, would be a possible verbal problem for the algorithm. Each student should write the problem on his chalkboard. The following question-answer thought process should be followed for the problem.

1. Question: How many hundreds will each school get?
   Answer: One

2. Question: Are there any hundreds left?
   Answer: Yes - one

3. Question: How many tens will this make?
   Answer: Ten

4. Question: How many tens do you have altogether?
   Answer: Fourteen

5. Question: How many tens will each school get?
   Answer Four

6. Question: Are there any tens left?
   Answer: Yes - two

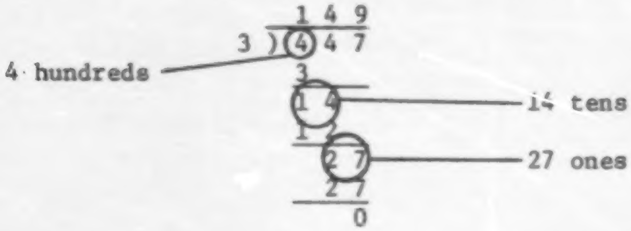
7. Question: How many ones will this make?
   Answer: Twenty-seven

8. Question: How many ones will each school get?
   Answer: Nine

9. Question: Are there any ones left?
   Answer: No

10. Question: How many books will each school receive?
    Answer: One hundred forty nine

The completed algorithm would look like:



NOTE! When recording the quotient make sure the number of hundreds, tens and ones are placed over the appropriate places.

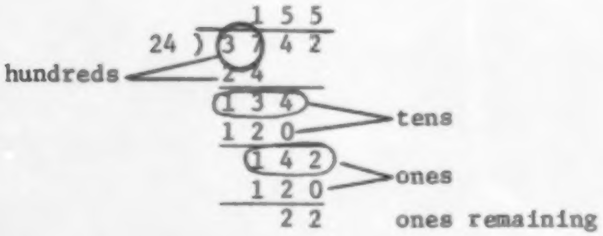
At this point in the study of long division the students should be ready to give up the sticks and only work with the algorithm. They should also be able to solve problems involving two or three digit division.

Concept: Division problems involving multi digit divisors and dividends.

Activity #7: Place a problem on the chalkboard for the students to solve. The students could use paper and pencil or individual chalkboards on which to work their problems.

Example of one problem:

$24 \overline{)\,3,742}$ The students could think of this as 3,742 cars to be parked into twenty four parking lots.



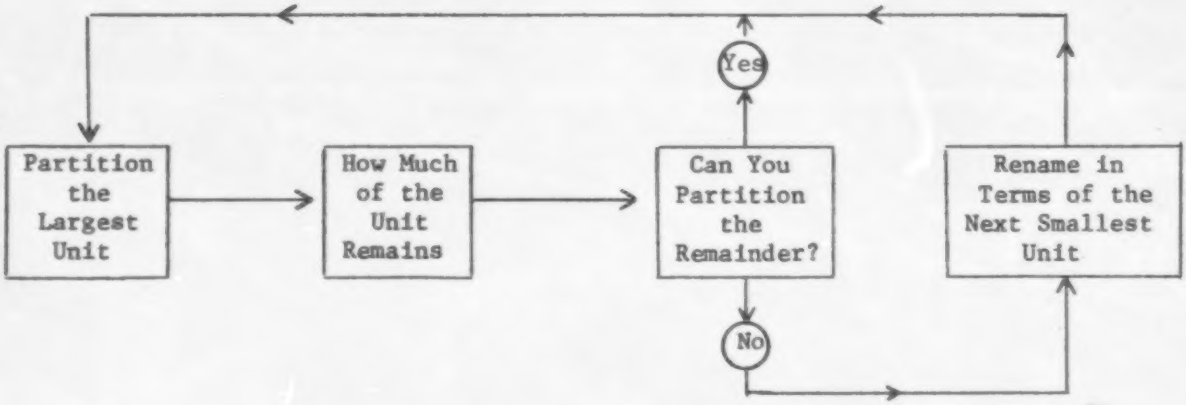
Reasoning pattern for $24\overline{)3,742}$

The student tries to partition the thousands, can't, so renames the three thousands and seven hundreds to thirty seven hundreds ⟶ partitions the hundreds so that one group of one hundred cars will be in each lot ⟶ determines that thirteen hundreds remains ⟶ tries to partition these into twenty four lots, cannot ⟶

renames thirteen hundreds and four tens to one hundred thirty four tens ⟶ partitions the tens so that five groups of ten cars will be placed in each lot ⟶ determines that fourteen tens remains ⟶ tries to partition these into twenty four lots, cannot ⟶ renames fourteen tens, two ones to one hundred forty two ones ⟶ partitions these ones so that five single cars are placed in each lot ⟶ determines that twenty two ones remains ⟶ tries to partition, cannot, therefore concludes that one hundred fifty five cars should be placed in each lot with twenty two cars left on the street.

****

FLOW CHART FOR LONG DIVISION
(Partitioning Sets)


Partition the Largest Unit
How Much of the Unit Remains
Can You Partition the Remainder?
Yes
No
Rename in Terms of the Next Smallest Unit

MEASUREMENT

General Introduction

Measurement is a form of comparison, involving the matching of an object or quantity being measured and a unit of measurement. For example, to measure a line segment, the segment is matched with an arbitrarily-chosen unit line segment. If the line segment that is being measured matches four of the chosen units, then the length of the line segment is four units (the units being inches, feet, etc.). This matching always results in a number which is known as the measure. In the above example, the measure of the line segment is four. In order to convey the full meaning of the measuring, one combines the measure with the unit, and says "four inches," "four feet," etc. This concept of measurement can be extended to include the measurement of capacity. When measuring capacity, the unit of measurement which is used in the comparison is one of the folowing: quarts, pints, cups, etc.

Time is something that is not measured directly. Rather than comparing a unit of time being measured, time is compared with another quantity (sand in an hourglass, numerals on a clock, shadow on a sundial) which has been calibrated by comparison with other measuring devices.

MEASUREMENT OF CAPACITY
(English Measurement)

Introduction

Capacity measurement is a form of comparison. The standard units of capacity (cup, pint, quart, half gallon, gallon) are compared with the given amount of liquid. The "equals" symbol should not be used when referring to the relationship between two units of measurement. (e.g., it is not correct to say "two cups equals one pint.") The "equals" symbol is used for number sentences which give two names for the same number. For measuring, the word "make(s)" should be used instead of the "equals" symbol. (e.g., two cups make one pint.) One pint is equivalent to two cups, since they both measure the same amount of liquid, but the units of measure are not identical things, so the equality symbol is not used.

Concept: Capacity (cup, pint, quart, gallon)

Equipment: Cup, pint, quart, half gallon, gallon, bucket of water or sand or aquarium gravel, pitcher

Activity: With very young children or immature children the teacher will want to present just two units of capacity such as cup and pint. Then as the child progressess add the quart - then add the half gallon, then the gallon.

The child should be allowed to find out how many cups are in a pint by pouring full cups into the pint container until the container is full.

If you are working with the more able student you may want him to estimate how many cups are in a pint.

pints in a quart
cups in a quart
quarts in a half gallon
cups in a half gallon
pints in a half gallon
quarts in a half gallon
cups in a gallon
pints in a gallon
quarts in a gallon
half gallons in a gallon

As he estimates he keeps a record of what he thinks is the right answer. Then he actually works with the container to find out the right answer.

****

Concept: Capacity

Equipment: Cup, pint, quart, half gallon, gallon, sand or aquarium gravel

Activity: Have children estimate how many cups, pints, quarts, half gallons or gallons it will take to cover a 5" square and make a pyramid. Do the same with a 6" square, etc. Change to rectangles and triangles.

****

Concept: Capacity

quipment: Cup, pint, quart, half gallon, gallon plus a big container

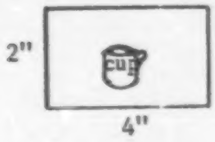
Activity: Have the children estimate how many cups, pints, quarts, half gallons or gallons it will take to fill the big container. Have them write down their own estimates on their own paper. Then let them actually fill up the container and count the cups used, pints used, or quarts used.

****

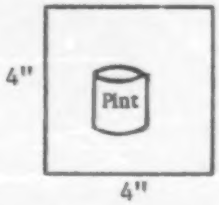
Concept: Capacity (cup, pint, quart, gallon)

Equipment: Magnetic board, flannel pictures representing a cup, pint, quart, half gallon and a gallon (Each unit of measure should be different colors of flannel.)

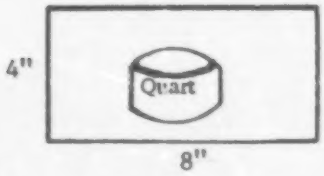
Activity: The flannel picture for a cup is a 2" x 4" rectangle with a drawing of a cup on it:



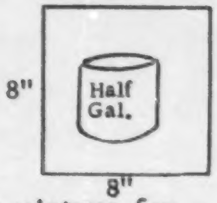
The picture for a pint is a 4" x 4" square with the following drawing on it:



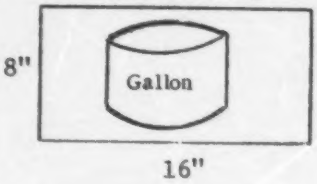
The picture for a quart is an 8" x 4" rectangle with the following drawing on it:



The picture for a half gallon is an 8" x 8" square with the following drawing on it:



The picture for a gallon is a 16" x 8" rectangle with the following drawing on it:



The picture representing the pint is placed on the flannel board. The children must estimate how many cup flannel pieces it will take to cover all of the pint piece. Someone should place the flannel pieces on the pint flannel piece until all of it is covered. One child then gives a verbal description of what has taken place. ("Two cups make a pint.") This activity is repeated as the children find the relationships between: cups and quarts, pints and quarts, cups and half gallons, pints and half gallons, quarts and half gallons, half gallons and gallons, etc.

****

Equipment: Magnetic board, construction paper objects representing a cup, pint, quart, half gallon and gallon. (Each unit of measure should be made from a different color of construction paper.)

Activity: The construction paper objects should be the same dimensions as the flannel pictures in the preceeding lesson. The children are to find the relationships that exist between the different measures by manipulating the construction paper objects. The relationships should be verbalized and recorded on the chalkboard.

****

Concept: Capacity

Equipment: Overhead projector, overhead transparencies that represent: A pint (2" x 2" square), a quart (4" x 2" rectangle), a half gallon (4" x 4" square), a gallon (4" x 8" rectangle); flannel pieces that represent a cup (2" x 1" rectangle), a pint (2" x 2" square), a quart (4" x 2" rectangle), a half gallon (4" x 4" square)

(NOTE: Each measure should be a different color.)

Activity: The relationships that exist between the measures are determined by having the students place the flannel pieces on top of the transparencies. (e.g., four flannel cups will fill the pint transparency.) The relationships are written on the board as they are found.

****

MEASUREMENT OF LENGTH
(Linear Measurement)

Introduction

Measurement is a form of comparison. When a person asks, "How many feet are in the length of this room?" he is comparing the length of a standard unit (the foot) with the length of the room. What is actually meant is: "How many units are contained in the total set of units?" or, "How many units will fit along this length?"

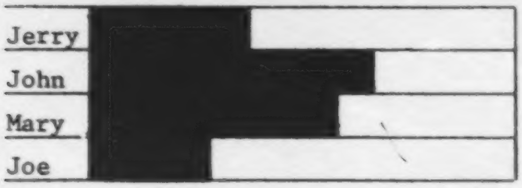
The units of measure selected to compare quantities such as length are arbitrary. Standard units such as the inch, foot, and yard have been established to facilitate communication, and they have a social and historical rather than a mathematical basis. When one talks about the length of an object he is referring to how many standard units are contained in the length.

Concept: Linear Measurement

Equipment: Children's pencils

Activity: Have the children measure the length of a book, window, desk, door, etc., in pencil lengths. Make a graph for each object measured.

Book size in pencils' length



Help the children see that a standard unit of measurement is needed to measure accurately.

****

ncept: Measurement in length

Equipment: String, paper clip necklaces, drinking straws, etc.

Activity: Allow children to measure various objects in the room using whatever equipment they want to use. Have them record their findings. Discuss with them what they have found. Lead them to realize that had everyone used the same unit of measurement the results would have been very similar.

****

Concept: Measurement of length

Equipment: Foot ruler, four objects

Activity: Allow the children to measure the same four objects. Compare their findings. Lead the children to see the similar results.

****

Concept: Linear measurement

Equipment: None

Activity: The children are told to measure the width of the classroom. They will use their feet as the unit of measure. They should count the number of feet it takes for them to walk the distance, placing each foot end to end while walking. The teacher writes down the number of feet required for each child. The distance could be referred to as 25 "Mary feet", or 21 "John feet", etc.

A graph can be made showing the different measurements. Small construction paper "footprints" are used on the graph. For the above example, Mary would have 25 "footprints", and John would have 21. The graph points out that when different units of measure are used, different answers for the same measurement are obtained. This is why it is important to use a standard unit of measurement (inch, foot, yard, etc.).

****

Equipment: Foot rulers

Activity: The children measure the width of the classroom. They are to use a foot ruler as the unit of measurement. If done correctly, the measures should be the same. This is compared with the results of the activity when the children used their feet as the unit of measurement. When using their own feet as the unit of measurement, the answers depended on the size of the feet. This again emphasizes the need of a standard unit of measurement (inch, foot, yard, etc.).

****

Equipment: Measuring wheel

Activity: Two children work together to measure long distances. Some things they might measure are: the length of the classroom, the length of the hallway, the length of the sidewalk in front of the school, the length of the playground, etc. An explanation of how to operate the measuring wheel is included in the section on teaching aids.

****

quipment: Inclined plane, toy car, ruler

Activity: The children are to release the car at the top of the inclined plane. This will allow the car to travel a certain distance. The students are then to measure the distance the car has traveled, using the distance between the foot of the inclined plane and the front of the car (where it has come to rest). The distance should be measured in both inches and feet. A contest can be made out of it, by seeing who can make the car travel the greatest distance.

****

Equipment: Six foot rule (usually found with scales in school's health office)

Activity: The height of each child in the room is measured (correct to the nearest quarter inch). The teacher cuts out strips of paper to the following measurements: ten inches long, one inch long, one half inch long, and one fourth inch long. A chart showing each child's height can be made by laying the strips of paper end to end. This may be done vertically or horizontally. Each bar is labeled with the child's name. By comparing the heights of the bars, the following facts can be determined: the tallest child in class, the shortest child in class, and those children who are the same height. If the children are measured at the beginning of the year, and then again at the end of the year, one can see how much they have grown by comparing the heights of the bars representing their two heights.

****

Equipment: One inch counting blocks, foot ruler, yardstick

Activity: The children are to determine how many one inch counting blocks are in a foot ruler. They can find out by placing the blocks end to end along the foot ruler, until the string of blocks is the same length as the ruler (the answer should be 12 blocks).

The following equivalent should be a result of the above activities:

12 inches make a foot

****

Concept: Linear measurement

Equipment: Magnetic board, magnetic strips (one inch and one foot long)

Activity: The magnetic strip representing one foot is placed on the magnetic board. A pupil is given a tray full of one inch magnetic strips. He then determines how many inches there are in a foot. He does this by putting the one inch strips end to end under the one foot strip, until both are the same length.

****

Concept: Linear measurement

Equipment: Individual chalkboards, rulers

Activity: The children are told to draw line segments of different lengths on their chalkboards. They must write the measure of the line segment above the segment.

****

Equipment: Overhead projector, projector pen, transparent ruler

Activity: Several line segments are drawn on the overhead projector. A student then finds the length of each segment, correct to the nearest inch. He writes the numberal that represents the number of inches in the measure on the line segment. This can be repeated with other students and other line segments.

****

Equipment: Blocks, counting sticks, ruler

Activity: The children are to measure the width and the length of their desks, using different units of measurement. The teacher may ask them, "How many counting sticks wide is your desk?" "How many inches long is your desk?" The reasons for getting different answers for the same measurement should be discussed. The children then measure other objects in the classroom. It is fun to let them make up their own units of measurement.

Continue activities using various objects having specific number of units (e.g., find an object 13 inches long, etc.).

****

MEASUREMENT OF TIME

Introduction

The Mathematics Instructional Paraprofessional may want to introduce the clock face as a circular number line, for the divisions are evenly spaced around the circle. The first activity should be concerned with whole hour times. The word "o'clock" can be discussed, with the pointing out that it means "of the clock". It should be explained to the children that when the larger hand is at twelve, the smaller hand signifies the specific hours and the larger hand signifies that it is exactly that hour. When teaching the half hour, the teacher should use phrases such as "half past one" or "half past two". After the children understand that there are sixty minutes in a full hour, they are ready to read times in terms of "minutes".

Concept: Time

Equipment: Paper plates, brads, tagboard, hour and minute hands

Activity: The students draw a circle on their paper plates. The circle is marked off into twelve equal divisions. These divisions are labeled with the numerals, 1 - 12. Or the Mathematics Instructional Paraprofessional may wish to duplicate numerals, to be cut and glues in place by children. Each plate could be premarked with a dot and child glues correct numeral over the dot. The minute and hour hands are attached to the paper plate by placing a brad through them and through the center of the plate. Each child now has a clock face. Each one is told to set his clock at a different time. The clocks are then hold in the air for observation by the Mathematics Instructional Paraprofessional.

****

Equipment: Rubber band clock

Activity #1: The Mathematics Instructional Paraprofessional demonstrates the use of the rubber band clock. The clock is set to show different times. The children read the time after each new setting.

Activity #2: A child sets the rubber band clock to show a particular time (given verbally by the Mathematics Instructional Paraprofessional).

Activity #3: A time is written on the chalkboard. A child should set the rubber band clock so it shows this time.

****

Equipment: Demonstration clock

Activity #1: The clock is set at a particular time and the children are asked to state this time. The Mathematics Instructional Paraprofessional should begin with the time set on hour units (one o'clock, three o'clock, etc.), then go to half hours, quarter hours and finally minutes.

Activity #2: The teacher states a time (e.g., two o'clock). A student moves the hands of the clock so it shows this time.

****

quipment: 12 children in a circle, two children in the middle (one tall and one short), a minute and hour hand made of construction paper, a demonstration clock, 12 numeral cards numbered from 1 - 12

Acitivity: The 12 children join hands to form a circle. Each child has a numeral necklace around his neck (or the numerals may lay on the floor). These numerals are in consecutive order. As the teacher shows a time on her demonstration clock the two children in the middle make their construction paper hand point to the same time.

The rest of the class can take turns showing the same time the teacher shows.

****

Equipment: Magnetic board, magnetic apples numbered from 1 - 12, magnetic hour and minute hands

Activity: The teacher allows the child to show certain times on the magnetic board while the children at the seats show the same time on their paper plate clocks.

****

oncept: Time

Equipment: Flannel board, flannel clock face, flannel hour and minute hands, individual clocks

These are the directions for making the flannel clock face: Get a square piece of flannel (white is best), draw a circle on the flannel, mark the circle in twelve equal divisions, label these divisions with the numerals 1 - 12, and make an hour hand and a minute hand out of a different color of flannel. The same activities as described for the demonstration clock can then be used.

****

Concept: Time

Equipment: Overhead projector, overhead clock transparency

Activity: A circle is drawn on a transparency. It is then marked in twelve equal divisions. These divisions are labeled with numerals, 1 - 12. An hour hand and a minute hand are constructed from cardboard. The hour and minute hands are then attached to the center of the circle with a brad. The same teaching activities as described for the demonstration clock can be used this time.

****

Equipment: Overhead projector, transparencies showing clock faces with different times, overhead projector pen

Activity: A transparency is placed on the overhead projector. The teacher states the time shown on one of the clocks. A child then marks an "X" on the clock face that shows the time stated by the teacher. This is repeated with other clock faces.

****

Equipment: Geometric circles for each child, clock to manipulate for each child

Activity: The Mathematics Instructional Paraprofessional folds circle in half and child folds his circle in half. Students and the Mathematics Instructional Paraprofessional talk about this relationship to one half the amount of the clock face. The child needs to know that half of the circle is equivalent to 30 minutes on the clock. After folding the circle in half, then fold it in fourths and note this relationship to the quarter hours.

****

Activity #1: The flannel clock face is placed on the flannel board. The hour and minute hands are placed on the flannel clock face so that they represent a particular time (e.g., three o'clock). The students are asked to set their clocks to represent the same time.

Activity #2: A time is stated by the Mathematics Instructional Paraprofessional. The students set their clocks so the verbally stated time is shown on them.

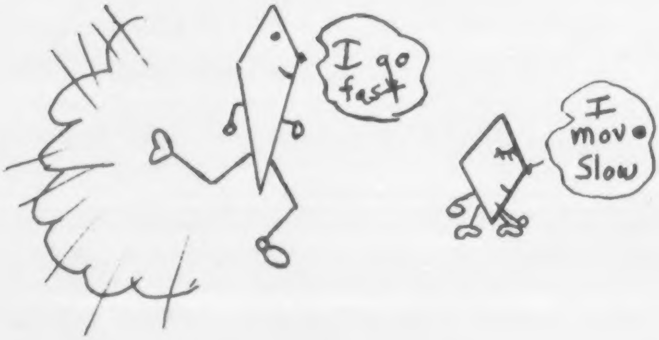
Activity #3: The children may set their clocks at any time they desire. They then hold their clocks in the air and tell the Mathematics Instructional Paraprofessional what time they have.

****

Concept: Time - movement of clock hands

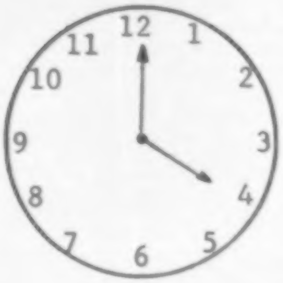
Equipment: Chart paper, marking pen, demonstration clock

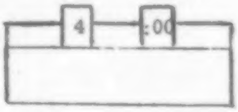
Activity: To relate concept of minute hand moving faster than hour hand, develop a class story about Mr. Speedy and Mr. Pokey. As story is written, show on clock that minute hand goes around the clock once, while hour hand goes from one numeral to another. (e.g., Mr. Speedy is tall and skinny. He is always in a hurry. He goes very fast. He can travel around the clock in 60 minutes. He is called the minute hand. Mr. Pokey is short and fat, and goes slowly. He is tired. It takes him a whole hour to move from one numeral to another. He is called the hour hand.) The story can be very simple or more involved, depending on the group. The following illustrations may also help children remember the minute hand and hour hand.



Equipment: Show-me-boards for each student, numeral cards for each student from 1 - 12, cards to designate times such as :15, :30, :45, :00, a demonstration clock

Activity: As the teacher shows a time on her demonstration clock the child shows the same time in his show-me card.





****

Equipment: Chalkboard full of clocks showing different times, papers that tell different times in a paper bag.

Activity: The child draws a paper and tells the time that is on the paper, then crosses out the time on the board that is the same time.

****

Equipment: Sheets of mimeographed paper showing clocks with different times or just different times written without clocks

Activity: Teacher verbalizes a certain time and has the child use different color crayons to mark the clocks to coincide with the times called.

****

GRANDFATHER TIME

Concept: Time

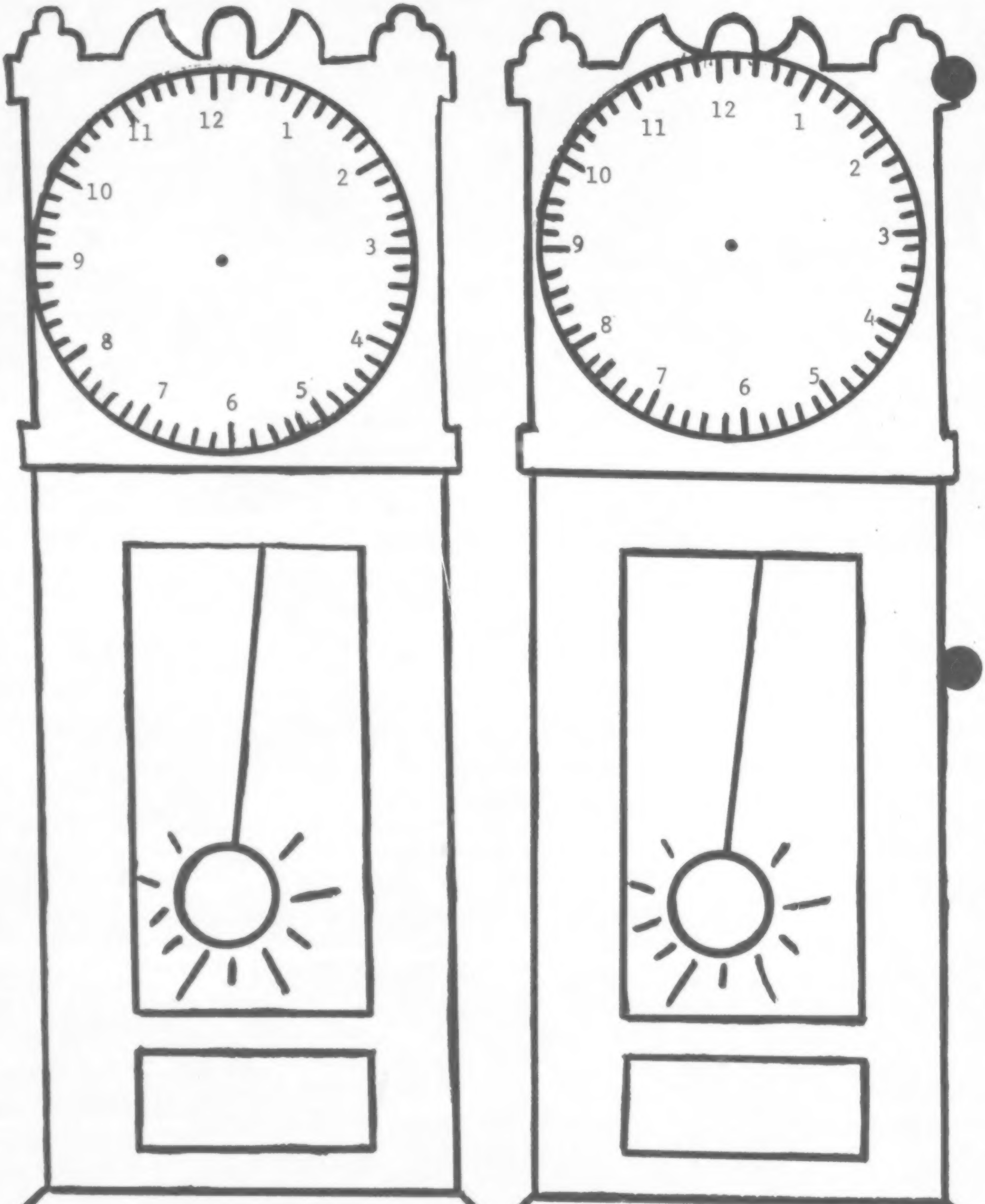
Equipment: Ditto pictures of grandfather clocks

Activity:

1. Each child has a clock of their own.
2. Child reads time written on front of clock.
3. Position hands on clock to tell the time.

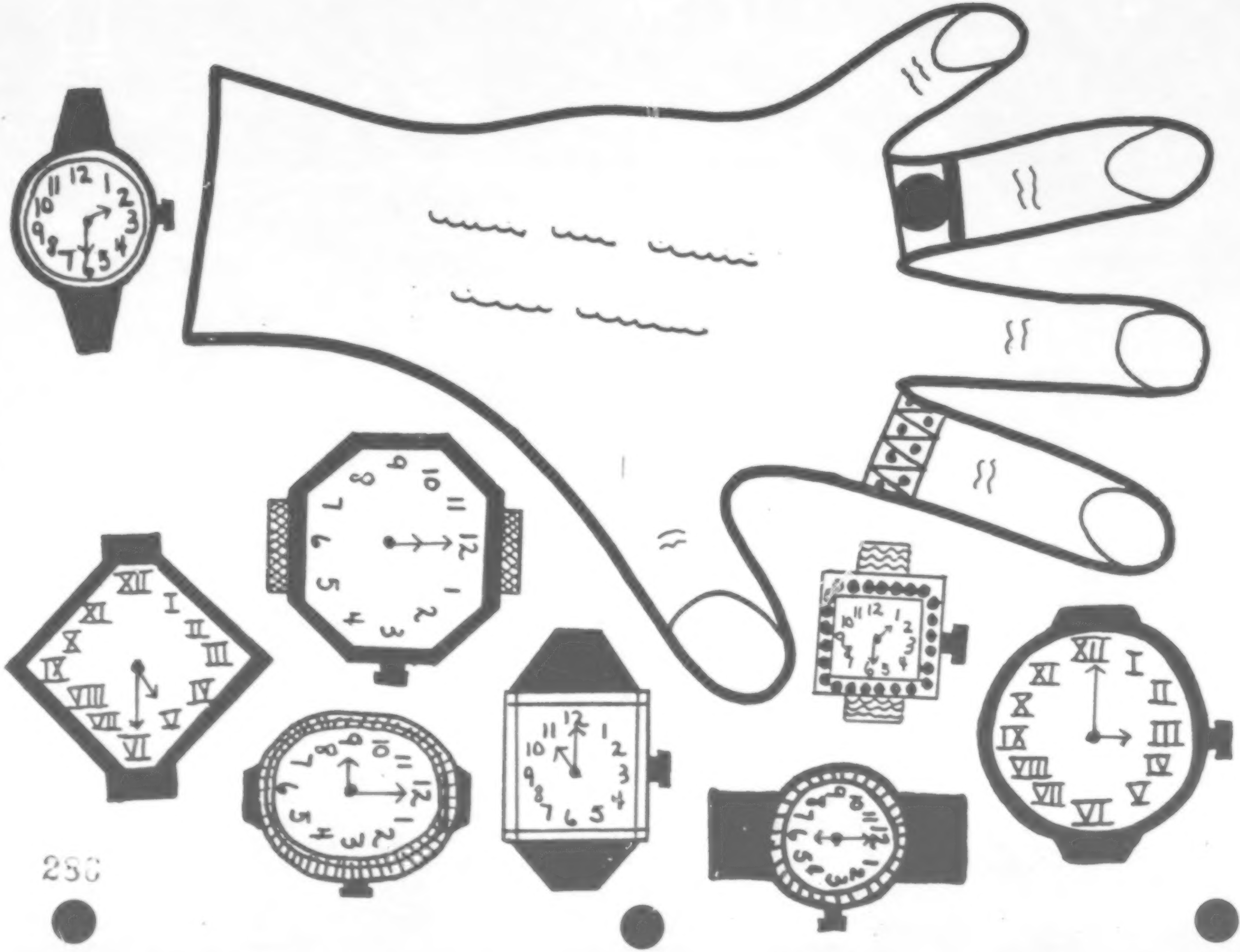
Ask Questions

1. What is your bedtime?
2. What time does school begin?
3. What time do you get up in the morning?
4. What time do you eat lunch?


12
1
2
3
4
5
6
7
8
9
10
11
12
1
2
3
4
5
6
7
8
9
10
11

WHAT'S MY TIME

terials:	four hands twenty-eight clocks
Procedure:	Each player receives a hand. All clocks are placed face up. The Mathematics Intructional Paraprofessional calls out a time and players look for it. First player to find the clock with that time places it on the wrist of his hand. Player who collects the most clocks is the winner.



MEASUREMENT OF MONEY

Introduction

The Mathematics Instructional Paraprofessional should not stress the learning of the names of coins unless the child has a good understanding of their value. These two concepts should go hand in hand. When naming a coin, the value of the coin should be indicated in some manner (counter frame, sets on flannel board, sets of counting objects, etc.) When this is done, a child cannot only name a coin but also has a mental image of the set that represents its value. This will make it much simpler to teach equivalent values, using different coins.

[illegible]ncept: Money

Equipment: Coins, counter frame

Activity #1: Actual coins should be used. A coin is held up for all to see. A child then gives its name and shows its value on the counter frame.

Activity #2: The name of a coin is stated. One child moves counters on the counter frame to indicate the value of the coin.

Activity #3: Counters are moved on the counter frame so that they represent the value of a coin. A child gives the name of the a coin. A child gives the name of the coin. (e.g., if five counters are pushed over, then the coin is a nickel.)

****

Concept: Money

Equipment: Magnetic board, coins with small magnets on their backs.

Activity #1: All the magnetic coins are placed on one side of the magnetic board. A numeral that represents the value of some of these coins is written on the board. One child selects the magnetic coins that represent this value and places them under the numeral.

Activity #2: Several different magnetic coins are placed on the magnetic board. One student determines the value of these coins and writes the numeral for this value on the board, under the coins.

****

Concept: Money

Equipment: Magnetic board, magnetic discs

Activity #1 A grid similar to the one below can be drawn on the magnetic board:

50	25	10	5	1	Value

Activity #2: Place discs on coin values. Ask the child to compute the value and write it in the right hand column.

e.g.,

50	25	10	5	1	Value
●			●	●	
	●	●		●	

Activity #3 Ask the child to place magnetic discs on whatever coins would give them the value shown on the right.

e.g.,

50	25	10	5	1	Value
					36
					61

Activity #4: Combine the above activities on the same grid.

e.g.,

50	25	10	5	1	Value
					40
	●		●		

****

Concept: Money

Equipment: Actual coins (penny, nickel, dime, quarter and half dollar)

Activity #1: Several coins of each denomination should be available. A child chooses 10¢ worth of coins (one dime, two nickels, one nickel and five pennies, or ten pennies). A different value is then stated and someone chooses coins that would represent this value.

Activity #2: A numeral representing the value of several coins (e.g., 78¢) is written on the board. Someone chooses coins that will represent this value. One possible answer for the example would be three quarters and three pennies.

****

Concept: Money

Equipment: Actual coins (penny, nickel, dime, quarter, half dollar), cash register, various commodities

Activity: Price tags are placed on the commodities. Each child is given a handful of coins. The children then choose one of the commodities they wish to purchase. They must take it to the cashier, have him ring up the amount of the purchase, and give him enough coins to equal its value. The cashier must make sure that he receives the correct coins. At first the Mathematics Instructional Paraprofessional should insist that the correct coins be given to the cashier. Later the children may purposely give the cashier too much money, so he or she has to make change. Each student should be given an opportunity to buy a commodity.

****

Concept: Money

Equipment: Mail order catalogs

Activity #1: Pupils select four items from catalogs for an "outfit" and then add up the cost.

Activity #2: Each pupil is given a $50.00 budget with which to buy a complete birthday outfit, from hat to shoes, underwear to coat, using the catalog.

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ncept: Measurement of Money-Make Change

Equipment: Commodities-Empty boxes, cans, bottles etc.
Toy cash register, money

Activity: Mark prices on the items brought for the store. Make all the prices less than one dollar. Fill the toy cash register with coins. Give each student a toy dollar bill. Choose different students to act as the storekeeper. The storekeeper will have to make change for the items purchased. Each student should be given the opportunity to select one item from the store to purchase. They will give their dollar bill to the storekeeper and the storekeeper will have to give the student back the correct change. Both the storekeeper and the student must agree that they have given and received the correct change. Give several students the opportunity to act as storekeeper. After every student has had the opportunity to buy something from the store, allow them to return to the store with their change to make an additional purchase. Being sure to count out the change for their purchase. When finished the students could count the change they have remaining. This activity could be repeated at various times during the school year.

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Concept: Money

Equipment: Overhead projector and transparencies, pointer

Activity #1: Show transparencies of coins (pennies, nickels, dimes, quarters, half dollars). Child uses pointer to show and name all the pennies, nickels, etc.

Activity #2: Looking at the transparencies the child adds the coins together for the total.

Activity #3: Have a transparency made of bills and coins. Child looks at the bills and coins and add total together.

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Concept: Money (budgeting)

Equipment: Newspapers, paper and pencils

Activity: Give the children the following information on a ditto: They will earn so much money per week and they will make a budget for a month. The sheet should also designate bills for utilities, food, shelter, transportation, doctor, recreation, savings.

Have students go through want ads of newspapers to choose jobs that state how much they would earn per hour, (figure eight hour day, five day week, four weeks per month). Let each student work individually on the project. Mathematical concepts which would be used would include: addition, subtraction, multiplication, division.

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PAY THE BANKER

(2-4 players)

Equipment:

Make a large dollar sign on a piece of eighteen-by-twenty-two inch poster board or pellon. Divide the dollar sign into squares writing amounts of money in some of the squares. Cut twelve pieces of two-by-three-inch poster board or tagboard for direction cards. Mark a dollar sign on one side and one of these directions on the other side and one of these directions on the other side of each of the cards:

You share your money with friends. Pay everyone 12¢.
You found some money and get a reward. Collect 67¢.
Property taxes are due today. Pay 58¢.
You must license your bicycle. Pay 27¢.
You caught the bank robber. Collect 52¢.
Your savings earn you interst. Collect 45¢.
Fire insurance is due. Pay 39¢.
Interest on your loan is due today. Pay 43¢.
Sales tax on new roller skates. Pay 18¢.
You mow the lawn. Collect 50¢.
Your dog got loose. You are fined. Pay 17¢.
Gasoline taxes must be paid. Pay 26¢.

set of toy money containing coins and dollar bills, a die, and a marker for ch player are needed.

Activity:

1. One player is selected to serve as banker. He gives each player a dollar bill to begin play. Each player puts his marker on the Start square. The dollar cards are put face down on the board.

2. The first player rolls the die and moves his marker. If he stops on a space marked with an amount of money, he collects from the banker. If he lands on a space marked with a dollar sign, he takes a card and follows its directions.

3. Play continues with each player taking his turns in order until all players have reached the end.

4. A player who runs out of money before he reaches the end may borrow from the banker, if he wishes. (Whether or not he borrows money will depend upon how far he is on the board and how much money other players have.)

5. The winner is the player with the most money after all have reached the end. (A player who borrows money must repay his loan before he figures the amount of money he has.)

EASY MONEY

Concept: Money

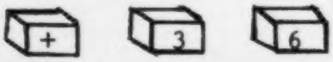
Equipment: Construction paper money - 60 one dollar bills
30 ten dollar bills
2" x 4" - yellow for ones
green for tens

three cubes - one cube + (plus) or - (minus) on all sides

container - to be used for bank

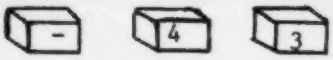
Activity: Distribute five (5) ones and one (1) ten and two (2) chips to each child leaving the rest in the bank container. Explain that when the three cubes are tossed, if the cube with pluses and minuses comes up + (plus) the banker gives them money and - (minus) the child gives the bank money.

Example #1



Bank give child $9.00. Child already has one ten and five ones plus nine ones. He must now trade in ten of the ones for a ten. (Have child verbalize what happened.)

Example #2



Child cannot give bank seven ones so he must trade his ten for ten ones. Child now has seventeen (17) ones and can give banker seven ones. (Child verbalizes what he has done.)

Play continues for time designated by teacher and winner is the one with the most money and both chips.

NOTE: When a child runs out of money, he may give a chip to the banker and receive a loan from the bank.

Game may be played with 4-6 to reinforce additon and subtraction facts through twelve. (Can also be used with $1. $5, and $10's.)

Concepts: Regrouping an addition and subtraction.

Concept: Money

ipment: Assorted items such as blocks, teddy bears, etc.

Activity: Items are placed in a row and each given a price. (A long narrow piece of tag board works well with prices written directly in front of each object). Each student is given an assorted amount of money and then makes a purchase and counts out that amount of money.

If "making change" is needed the students take turns being "banker".

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Concept: Money

This is useful in counting money and learning the value of each coin.

Equipment: Money board - made like a chip trading board with the different coins and $1.00 bill stamped or posted at the top of each column

Spinner - with coins glued in the secions

Cube - numbered as you wish

Activity: Each child in turn spins the spinner and rolls the cube, collecting the number of coins indicated by the spin and roll of the cube. He places the coins in the appropriate column and counts. Next turn he adds the new coins--does any trading possible and again count the new total.

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HELPFUL HINTS FOR MONEY

Use real pennies, nickels and dimes, know exactly how much each child has.

Pennies can be stacked into 5's then counted or traded for nickels. Then two nickels can be traded for dimes.

Pennies can be stacked into 10's then counting and trading practiced.

Put stacks of coins close together so it can quickly be discovered that a stack is shorter and therefore less.

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Garage Sale Cards

(Counting money or making change)

Glue pictures of items cut from a catalog to each side of a card. Write a price under each item. Each child puts his cards in front of him and the other players can buy cards from one another. Each buyer must count out money and each seller must check it to see if he has collected the correct amount.

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NUMBER CONCENTRATION

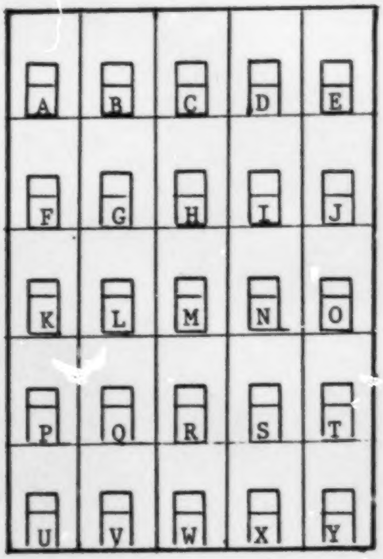
erials: five sets of cards numbered 3 - 7
(placed in game board)

set of cards numbered 11 - 8

Instructions: Each player in turn draws a card from the deck numbered 11 - 18.
The player then calls out two letters from the board to see if the two numbers add up to the given number. If they can come up with two numbers whose sum is the given number they get 3 chips. If it takes more than 2 numbers and they still add up to the number on the card they get only 2 chips. If they go over the number they get none. The one with the most chips at the end of your time period is the winner.

This can be used for additon facts, missing addend or subtraction. The children really like this activity. You might use a buzzer or clicker (whatever) to sound when they go over the number they selected, like a T.V. game show.

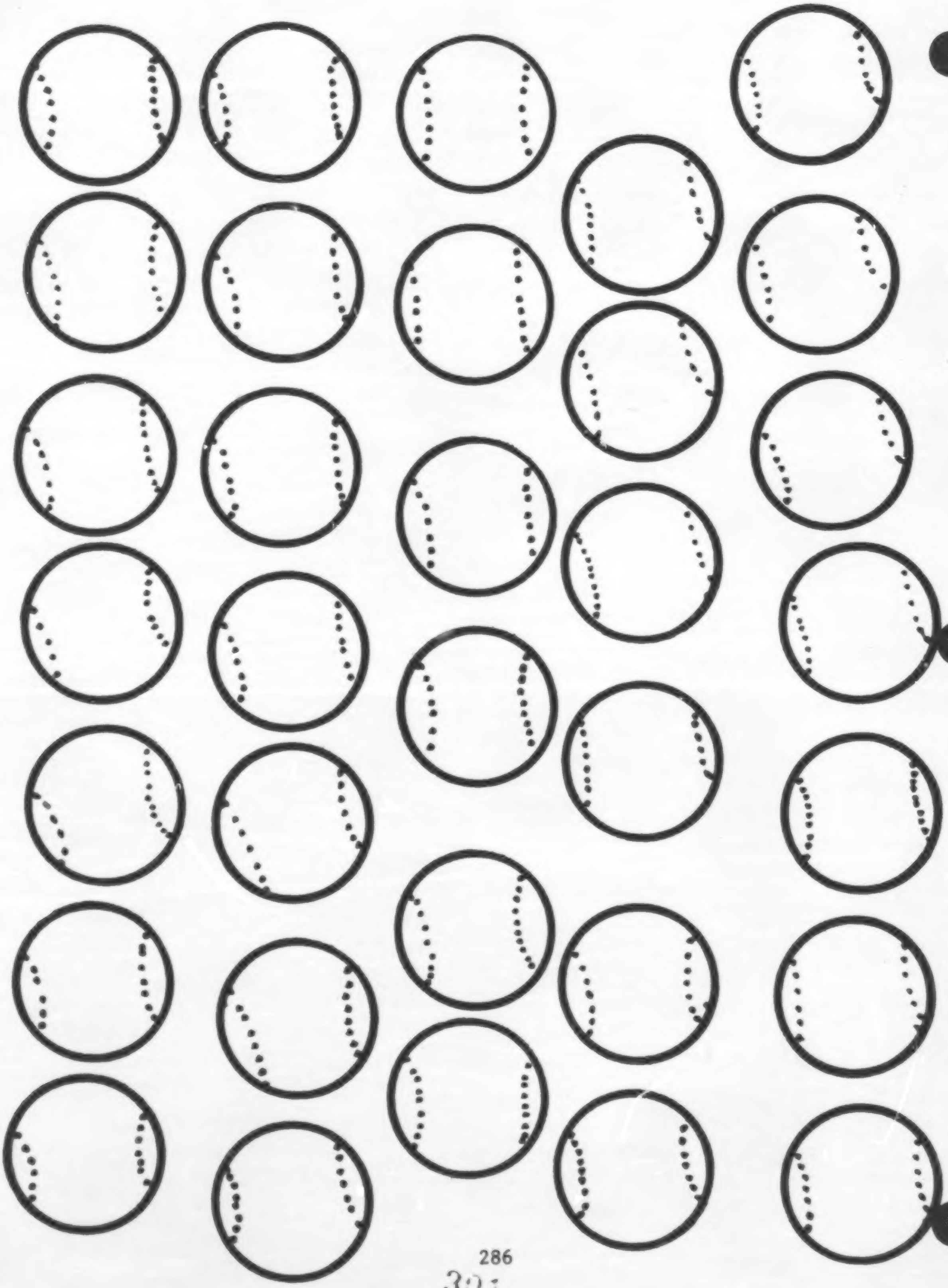
GAMEBOARD



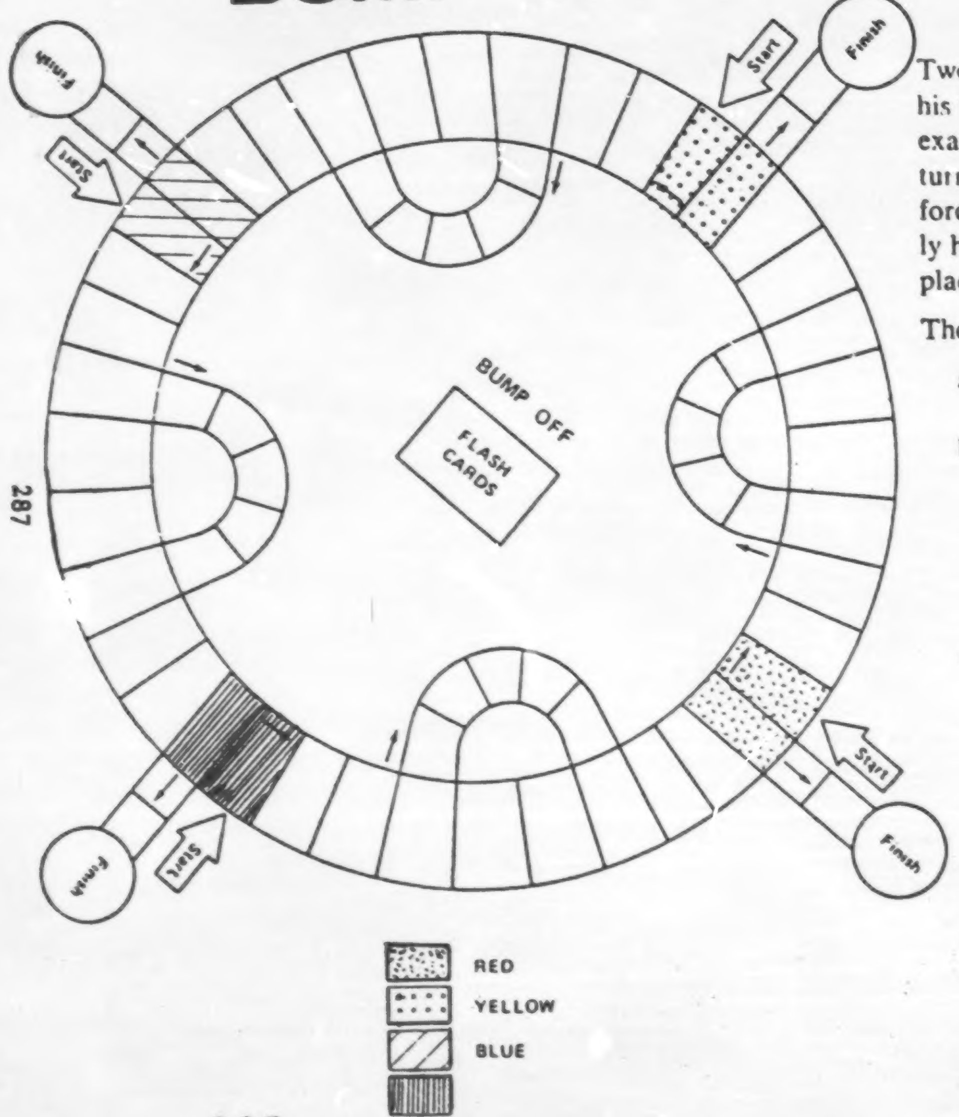
GRAND SLAM

Materials:	two gameboards baseballs
Procedure:	Construct gameboards, putting sums, differences, quotients, or products on the players' gloves. Put problems on the baseballs. Be sure to make some that do not fit.
Instructions:	Players play in pairs. Each player takes a playing board. They place the baseballs face down on the table between them. At a signal they start to turn baseballs over one at a time and place them on corresponding gloves. They may discard any baseball they have trouble placing and try another. The object is to place more baseballs than the opponent. The players with all ball gloves on his/her board correctly covered with baseballs is the winner. Play may end when all the baseballs are gone or at the end of a given time period.

Royals
One
Range
BREWE
Grand Slam



BUMP OFF



Two to four children can play the game. Each child begins by placing his two position markers on the starting arrows of the same color. For example, there would be two red markers on the red arrow. Taking turns, players must answer correctly the task on the top flash card, before rolling the dice and moving ahead. If the player answers incorrectly he may not roll the dice and his position marker remains in the same place.

The following rules guide the play on the Bump Off board:

a. Players must roll a six on either die to start a position marker on the Go space.

b. When both position markers are on the circular path, a player may choose to move one marker the total or both dice or move each marker the number indicated on one of the die. For example, if a player rolls a four and a three, he may move seven spaces with one marker or he may move one marker four spaces and one marker three spaces.

c. A player may "Bump Off" another player by landing on the same space that player occupies. The "Bumped" player must return his marker to his start arrow. For example, if player one rolls a four and player two is four spaces ahead, player one would land on the same space. Then player two would be "Bumped" back to his own starting arrow.

d. The half circle pathways around the board are safety zones. A player cannot be "Bumped" while in that zone. A player may not pass another player in the safety zone. At any given time a player may choose to move his marker into a safety zone to avoid being "Bumped." Each player's own Start space is also a safety zone for his own markers.

e. The winner is the first player to return both of his position markers to his finish space.

SCHOOL_________________________________ NAME_________________________________

Shade in the circle to indicate the student has demonstrated concept mastery.

GRADE K 1 2 3 4 5 6 (Circle current grade level)

1. **COMPARISONS**
   - ○ Large and small
   - ○ Tall and short
   - ○ Heavy and light
   - ○ Long
   - ○ More and less

2. **POSITIONAL RELATIONSHIPS**
   - ○ Under and over
   - ○ Top and bottom
   - ○ Front and back
   - ○ High and low
   - ○ Far and near
   - ○ Between
   - ○ Inside and outside

3. **PATTERNING**
   - ○ Two shapes
   - ○ Two colors
   - ○ Three shapes
   - ○ Three colors

4. **COUNTING BY ONES**
   - ○ Rational to 10
   - ○ Rational to 20
   - ○ Rational to 100
   - ○ Rote to 20
   - ○ Rote to 100
   - ○ Serial to 10
   - ○ Ordinals to fifth
   - ○ Ordinals to tenth
   - ○ Ordinals to twentieth

5. **COUNTING BY TWOS**
   - ○ Rational to 20
   - ○ Rote to 50

6. **COUNTING BY FIVES**
   - ○ Rational to 50
   - ○ Rote to 100

7. **COUNTING BY TENS**
   - ○ Rote to 100

8. **COUNTING BY HUNDREDS**
   - ○ Rote to 1000

9. **RECOGNITION OF SETS**
   - ○ (0-5)
   - ○ (0-10)

10. **ONE-TO-ONE MATCHING**
    - ○ Equivalent
    - ○ Non-equivalent
    - ○ One to ten
    - ○ One to fifty
    - ○ One to one hundred
    - ○ One to one thousand

11. **RECOGNITION OF NUMERALS**
    - ○ (0-10)
    - ○ (0-50)
    - ○ (0-100)
    - ○ (0-500)
    - ○ (0-1000)

12. **NUMBER WORD RECOGNITION**
    - ○ One to ten
    - ○ One to fifty
    - ○ One to one hundred
    - ○ One to five hundred
    - ○ One to one thousand

13. **FORMING SETS FOR NUMERALS**
    - ○ (0-10)
    - ○ (0-20)

14. **MATCHING NUMERALS WITH SETS**
    - ○ (0-10)
    - ○ (0-20)

15. **WRITING NUMERALS**
    - ○ (0-10)
    - ○ (0-50)
    - ○ (0-100)
    - ○ (0-500)
    - ○ (0-1000)

16. **ORDER OF NUMERALS**
    - ○ (0-10)
    - ○ (0-50)
    - ○ (0-100)
    - ○ (0-500)
    - ○ (0-1000)
    - ○ Number line

17. NUMBER COMPARISONS

○ Before
○ After
○ Between
○ One more
○ One less
○ Less than
○ More than
○ Even number
○ Odd number
○ Prime number
○ Number patterns

18. CONSERVATION OF SETS

○ (1-6)
○ (1-12)
○ (1-18)

19. JOINING SETS

○ (1-6)
○ (1-12)
○ (1-18)

20. ADDITION FACTS

○ (1-6)
○ (1-12)
○ (1-18)
○ Number line addition

21. SEPARATING SETS

○ (1-6)
○ (1-12)
○ (1-18)

22. SUBTRACTION FACTS

○ (1-6)
○ (1-12)
○ (1-18)
○ Number line subtraction

23. PLACE VALUE

○ Ones
○ Tens
○ Hundreds
○ Thousands
○ Millions
○ Billions
○ Expanded notations

24. RENAMING

○ Ones ⟷ Tens
○ Tens ⟷ Hundreds
○ Hundreds ⟷ Thousands

25. ADDITION OF WHOLE NUMBERS

○ Missing addend
○ 3 addends
○ 2 digit addends (no renaming)
○ 2 digit addends (renaming)
○ 3 digit addends (no renaming)
○ 3 digit addends (renaming)
○ 4 digit addends
○ Worded problems

26. SUBTRACTION OF WHOLE NUMBERS

○ 2 digit (no renaming)
○ 2 digit (renaming)
○ 3 digit (no renaming)
○ 3 digit (renaming)
○ 4 digit
○ Worded problems

27. EQUIVALENT SUBSETS

○ Twos
○ Threes
○ Fours
○ Fives
○ Sixes
○ Sevens
○ Eights
○ Nines

28. MULTIPLICATION FAC

○ To 3x3
○ To 4x4
○ To 5x5
○ To 7x7
○ To 9x9
○ Number line multiplication

29. SYMBOLS

○ (+) ○ (-)
○ (x) ○ (÷)
○ (<) ○ (>)
○ ($) ○ (¢)
○ (%) ○ (π)
○ Triangle
○ Square
○ Rectangle
○ Circle
○ (○) ○ (=)
○ Point ○ Segme
○ Ray ○ Line
○ ⊥ lines
○ Parallel lines
○ Intersecting lines
○ Angle ○ Right a
○ Right triangle
○ Quadrilateral
○ Parallelagram
○ Rhombus

29. SYMBOLS, cont.

○ Pentagon
○ Hexagon
○ Octagon
○ Cube
○ Cone
○ Cylinder
○ Sphere
○ Prism

30. CLASSIFICATION OF NUMBERS

○ Composite
○ Prime
○ Common fractions
○ Decimals

31. ROMAN NUMERALS

○ (I-X) ○ (X-L)
○ (L-C) ○ (C-M)

32. PARTITIONING SETS

○ By twos
○ By threes
○ By fours
○ By fives
○ By sixes, sevens
○ By eights, nines

33. DIVISION FACTS

○ To 9÷3
○ To 16÷4
○ To 25÷5
○ To 49÷7
○ To 81÷9
○ Number line division

34. MULTIPLICATION OF WHOLE NUMBERS

○ 10 as a multiplier
○ 2 digit by 1 digit
○ 2 digit by 2 digit
○ 3 digit by 2 digit
○ 100 as a multiplier
○ 3 digit by 3 digit
○ Worded problems

35. DIVISION OF WHOLE NUMBERS

○ 1 digit divisor (no remainder)
○ 1 digit divisor (remainder)
○ 10 as a divisor
○ 2 digit divisor
○ 100 as a divisor
○ 3 digit divisor
○ Worded problems

36. FRACTIONS

○ (1/2) ○ (1/4)
○ (3/4) ○ (1/3)
○ (2/3)
○ Regions
○ Sets
○ Fractional parts of one
○ Renaming in simplist form
○ Renaming in equivalent form
○ Mixed numeral ⟷ fractions
○ Order on number line

37. ADDITION OF FRACTIONS

○ Like denominators with sums less than one
○ Like denominators with sums greater than one
○ Unlike denominators
○ Mixed numerals

38. SUBTRACTION OF FRACTIONS

○ Common fractions with like denominators
○ Common fractions with unlike denominators
○ Whole number Common fractions
○ Mixed numeral Common fractions
○ Mixed numeral mixed numeral

39. MULTIPLICATION OF FRACTIONS

○ Common with 1 as a numerator
○ Common fractions
○ Whole number x common
○ Improper x common
○ Improper x Improper
○ Mixed number x common
○ Mixed number x mixed number

40. DIVISION OF FRACTIONS

○ Whole number ÷ common
○ Common fractions
○ Improper ÷ common

40. DIVISION OF FRACTIONS, cont.

○ Improper ÷ improper
○ Mixed number ÷ common
○ Common ÷ mixed number
○ Whole number ÷ mixed number

41. DECIMAL FRACTIONS

○ Tenths
○ Hundredths
○ Thousandths
○ Order on number line

42. DECIMALS

○ Place value
○ Expanded notation
○ Addition
○ Subtraction
○ Multiplication
○ Division

43. ENGLISH MEASUREMENT

○ Cup ○ Pint
○ Quart ○ Gallon
○ Inch ○ Foot
○ Yard
○ Ounce ○ Pound

44. MEASUREMENT OF TIME

○ Hour
○ Half-hour
○ Quarter time
○ Exact time

45. METRIC MEASUREMENT

○ Metre ○ Litre
○ Gram
○ Centi- cm, cg, cl
○ Deci- dm, dg, dl
○ Deka- dam, dag, dal
○ Kilo- km, kg, kl
○ Milli- mm, mg, ml
○ Hecto- hm, hg, hl

46. MEASUREMENT OF MONEY

○ Penny ○ Nickel
○ Dime ○ Quarter
○ Half dollar
○ Dollar
○ Knows values
○ Makes change

47. MEASUREMENT OF GEOMETRIC FIGURES

○ Angles in degrees
○ Perimeter of polygons
○ Circumference of circles
○ Area of rectangles
○ Area of triangles
○ Area of circles
○ Volume of prism

48. INTERPRETATION OF GRAPHS

○ Charts and tables
○ Pictorial
○ Line
○ Bar
○ Circle
○ Number pairs

49. CONSTRUCTION OF GRAPHS

○ Charts and tables
○ Pictorial
○ Line
○ Bar
○ Circle
○ Number pairs

50. MATHEMATICAL APPLICATIONS

○ Compute averages
○ Compute percentages
○ Use formulas
○ Ratio--Proportion problems
○ Solve equations
○ Rounding numbers
○ Congruent figures
○ Story problems
○ Money story problems

51. INTEGERS

○ Positive
○ Negative
○ Opposites
○ Addition
○ Subtraction